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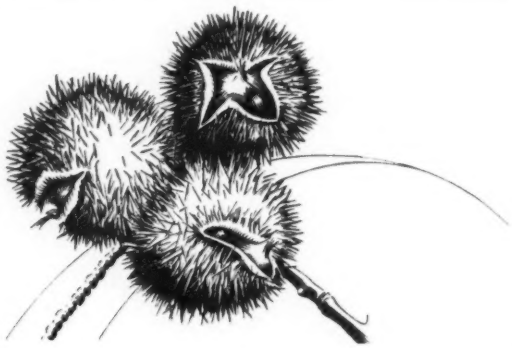

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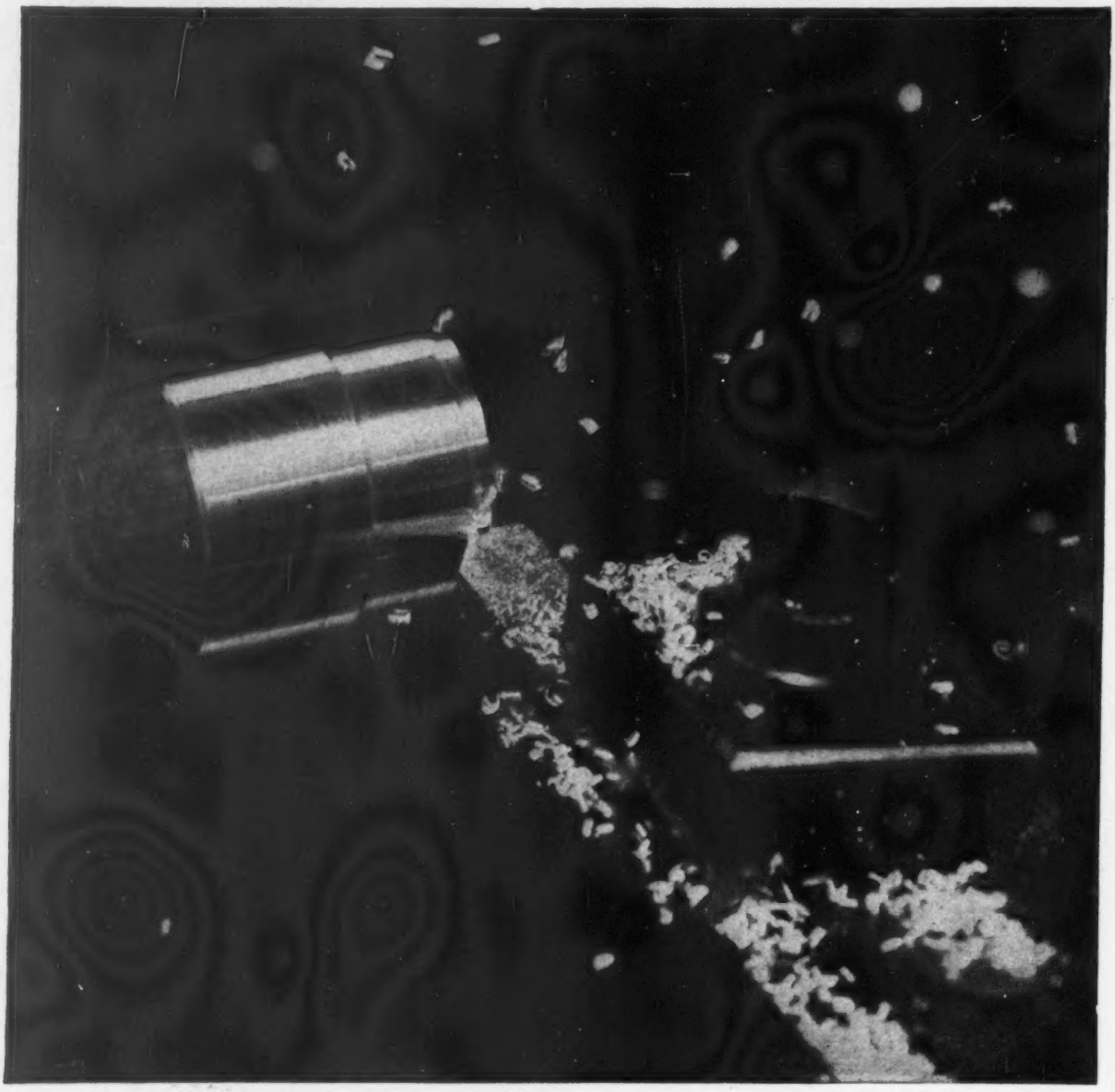

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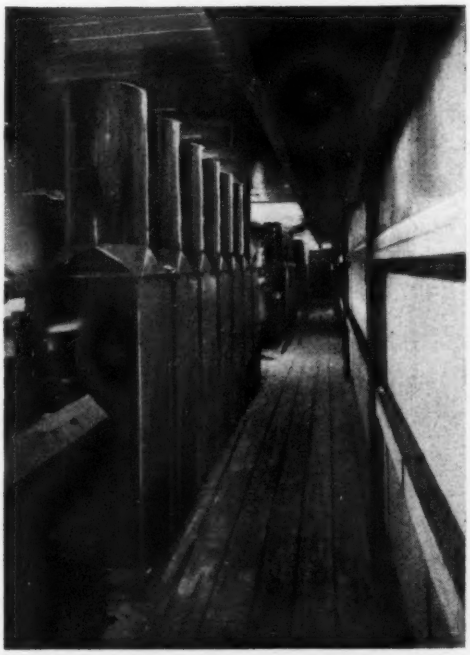

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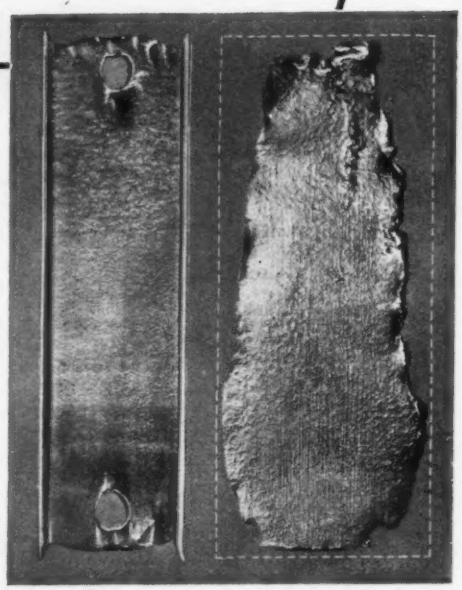

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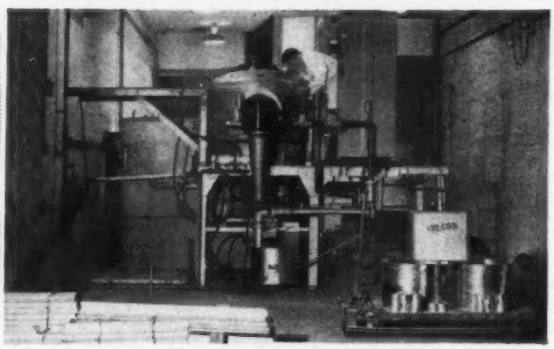

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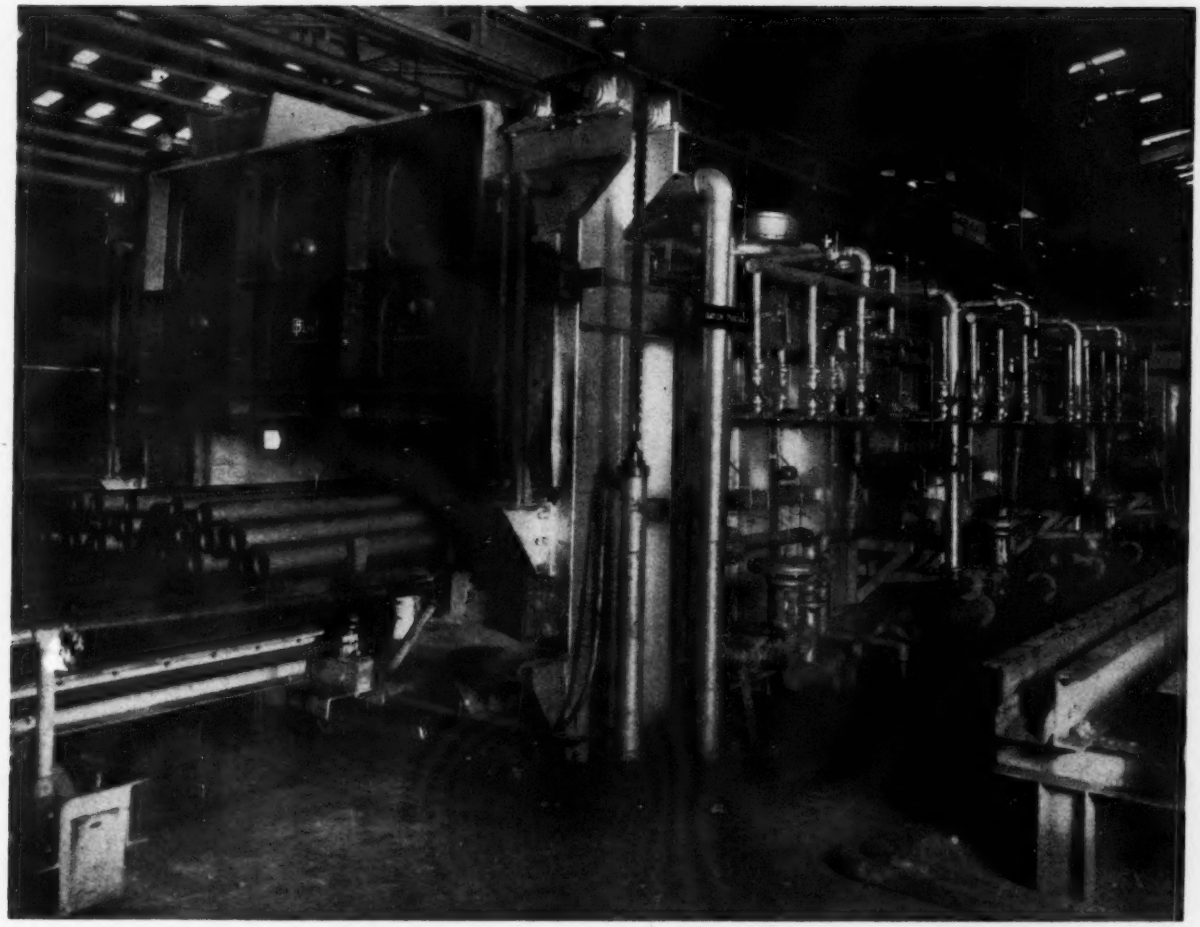

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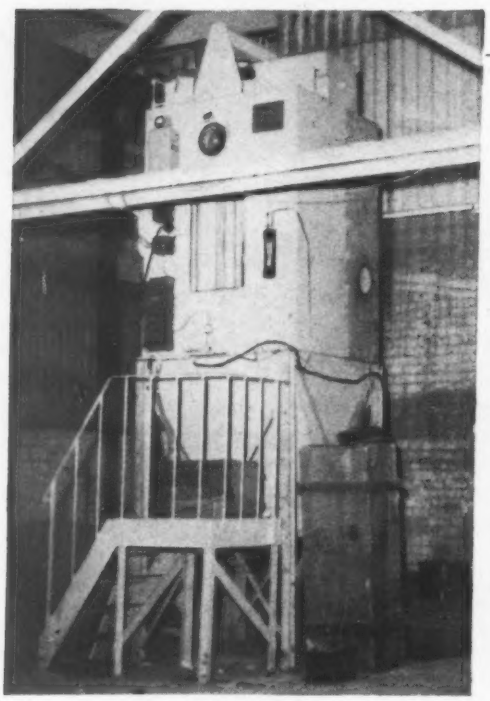

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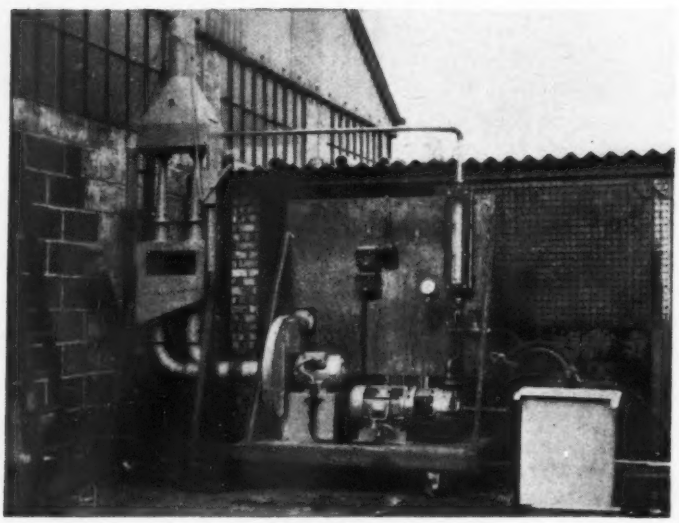

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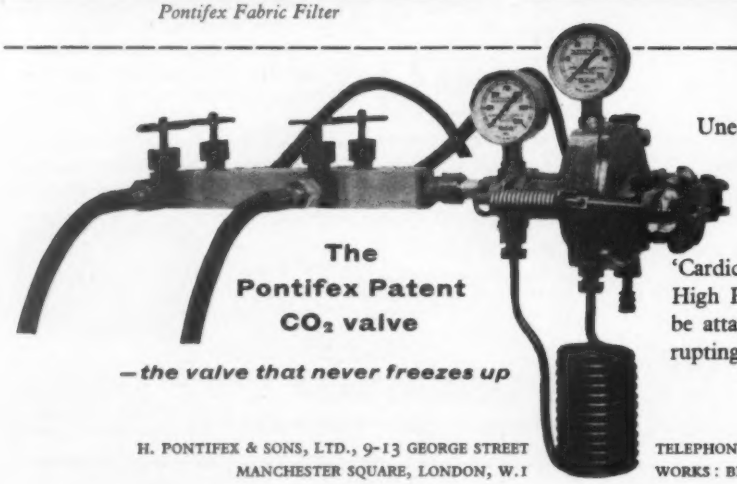

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METAL INDUSTRY

FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

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Soviet Metal Industries

SOME very interesting figures are given in a report issued this month by the United States Bureau of Mines dealing with the foreign mineral trade of Soviet Russia for the year 1957, and which contains the latest available block of statistics for the Soviet group of countries. Although some trends may not as yet be recognized, there appears to be no doubt about the great importance of minerals and metals in the Soviet foreign-trade picture, and in Soviet relations to other countries within and without the Soviet bloc. The growing mineral and metal self-sufficiency of the Soviet Union has enabled that country to raise its exports of mineral commodities so that during the years 1955-57 the value of mineral exports increased at a much greater rate than total trade. In fact, while the value of all exports during that three-year period rose by 26 per cent, the value of mineral exports increased by more than 68 per cent. Thus, the proportion of mineral commodity exports expanded from approximately one-quarter of the total in 1955 to nearly 35 per cent of the total in 1957.

Although Soviet export statistics include re-exports, it is evident that increasing quantities of indigenously produced minerals and metals are being exported. This trend undoubtedly will continue for some time as the Soviet broadens its domestic mineral production base and seeks to demonstrate its mineral wealth and growing mineral output to economically underdeveloped nations. The greatest gains in the Soviet mineral export trade were made in the field of mineral fuels while, probably because of the decline in the steel development rate, exports of ferrous metals increased only at approximately the same rate as total exports.

When we turn to the non-ferrous metal section of Soviet trade we find that, combining expanding indigenous output together with re-exports and possibly inventory reductions, the Soviet Union increased the value of their non-ferrous metal exports by *over* 80 *per cent* during the period 1955-57. The greatest gains were made in shipments of zinc, lead, aluminium, and, of course, tin. On the other hand, the total value of Soviet non-ferrous metal imports changed very little. Thus, in 1957 exports of non-ferrous metals were valued at 811·6 million Soviet roubles, compared with 442·9 for the year 1958. Expressed as a percentage of total exports, the corresponding figures were 4·7 and 3·2. On the other hand, imports for the same years were valued at 510·6 and 532·4 respectively, and were 3·2 per cent and 4·4 per cent of the total imports.

Except for a large copper tonnage, small quantities of lead, and occasionally aluminium, all non-ferrous metals imported into the Soviet Union originate in the Sino-Soviet bloc. With the exception of tin, which is delivered from China, shipments of other non-ferrous metals from the bloc nations to the Soviet Union gradually diminished. To the extent that trade statistics for any three consecutive years are able to reflect basic trends, certain patterns appear to be evolving in the Soviet Union's foreign mineral trade policy. These patterns appear to be consistent with the reported Soviet economic expansion programme and its drive towards greater mineral self-sufficiency.

Out of the MELTING POT

Reminder

APART from the direct interest shown in corrosion, the indirect concern with the chemical properties and behaviour of metals in connection with the various chemical surface treatment processes and, more recently, with the chemical machining of metals, little interest is shown in the chemical behaviour of metals. Beyond these fields, however, any realization that a metal or alloy has various chemical properties, which must necessarily produce certain effects on certain occasions, tends to dwindle to vanishing point, metals and alloys being regarded solely as physical solids and their behaviour in deformation and fracture as completely explicable in terms of slip, dislocations, vacancies, cracks, and such like physical, not to say geometrical, manifestations. A striking reminder of the fact that fracture of a metal can involve more than just a physical manifestation has recently been provided by the observation that, in the case of titanium, the formation of a fresh surface by, for example, the breaking of a tensile test piece, will result in spontaneous ignition of the metal if an adequate pressure and concentration of oxygen are present. For ignition to occur, the pressure required in pure oxygen is 350 lb/in^2 or higher, and the concentration of oxygen in an inert or non-reactive gas must be not less than 35 per cent. With a flow of oxygen, as, for example, when a titanium bursting disc breaks, ignition will occur at pressures as low as 50 lb/in^2. Temperature appears to have little effect over the range between room temperature and 300°C. Once the metal has ignited, combustion depends on the melting of the surface metal by the heat liberated, and on the solution of oxides in the molten metal. It is certainly a far cry from the spectacular spontaneous ignition of a ruptured titanium bursting disc on a vessel containing compressed oxygen, to the unobtrusive chemical reactions which undoubtedly take place between constituents of the surrounding medium, whatever they may happen to be, and the minute areas of fresh surface exposed by the slip lines and bands on the surface of a fatigue, creep, or tensile test piece, or the very much larger fresh surfaces formed in the course of the working and machining of metals. If disentangled from the mechanical and geometrical aspects, however, these chemical reactions will certainly prove to be responsible for various quite important effects.

If Suitable

IT is often suggested that the presence of scientists and engineers on managerial councils is necessary in order to keep the facts of scientific and technical life before the other members of such councils, whose experience is "restricted" to the humanities and finance. Whether or not this point of view is justified depends on whether or not the experience of those other members can, in fact, be called restricted. This can be done only if a criterion, which is itself rather "restricted," is adopted. On this basis, managerial activities that do not include a full measure of science and technology are indeed restricted. On the other hand, this evaluation does not take into account that activities over a field that is more and more restricted are increasingly becoming the order of the day. There appears to be no reason why, of all activities, management should pursue a course of development running counter to this present-day all-pervading trend towards greater and greater specialization. And if it is a specialized activity, which it undoubtedly is, those who engage in it must of necessity be specialists. Whether or not such specialists are born, trained, or, nowadays, "groomed" for management is another question. Whatever the process, the specialized end product is, however, invariably a successful specialist, whose success, as in any other walk of life, depends on how good he is at his specialized job rather than on a background which in this context is merely incidental. Opportunities for the rise of scientists and engineers to managerial levels are always desirable. By contrast, however, management being what it is, it cannot profit from having scientists and engineers thrust upon it. Neither, incidentally, can they.

Dislocations Observed

HOWEVER admirable the theories regarding the nature and behaviour of dislocations in metals, they have hitherto suffered from the lack of more direct experimental and observational supporting evidence. What evidence of this kind there has been was inclined to be disappointingly remote from metals as they are known in everyday life. High-purity silicon or germanium, single crystals, specially-controlled deformations, pits produced by special etching techniques: the need for all these for the purpose of demonstrating what, after all, were claimed to be universal phenomena, always seemed rather unfortunate. A great improvement in the appreciation of dislocation phenomena may, therefore, be expected from the development of techniques enabling the application of electron transmission spectroscopy to specimens which, although necessarily "special," are, nevertheless, derived from "ordinary" metal. Such specimens have been produced in the Research Laboratories of the Aluminum Company of America by electrolytic oxidation of aluminium. By continuing the process until the oxide films growing from the two surfaces of a sheet specimen meet, one is left with a large number of extremely thin metallic particles trapped between the two oxide layers. These particles are recovered by dissolving away the oxide in chromic acid-phosphoric acid solution. Examination of them by transmission electron microscopy, in the case of particles obtained from cold rolled aluminium, has revealed edge dislocation sites along grain fragments, the average spacing between dislocations being 71·4Å, corresponding to an angle of misfit between the two fragments of a little over 2°. The bombardment of the specimens by the electron beam during such observations can induce movements of dislocations to the grain boundaries. Such movements are accompanied by the development of a transitory trailing "tail," which shows up such movements even in those frequent cases in which the movement of the dislocations themselves is too rapid for direct observations. In specimens of annealed metal in which no dislocations are present, continued bombardment by the electron beam can cause slip and multiple glide. Although specially-prepared specimens are, in general, more satisfactory, they are not absolutely essential. For example, a profusion of tilt boundaries and dislocations has been observed in sufficiently thin flakes of commercial ball-milled aluminium powder.

Skimmer

MOLYBDENUM — NIOBIUM — TANTALUM — RHENIUM — TUNGSTEN

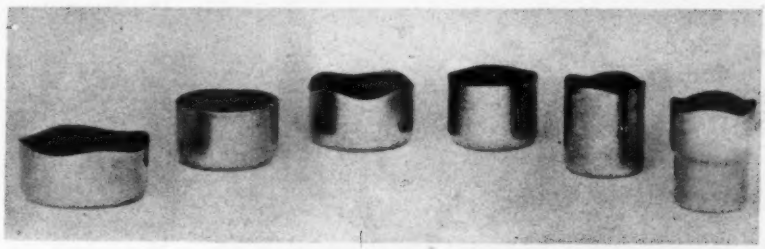
Fabrication of Refractory Metals

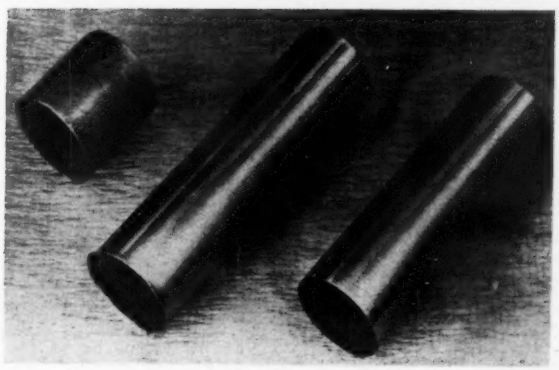
By W. L. BRUCKART

(*Continued from* METAL INDUSTRY, 23 *January* 1959)

ALTHOUGH no commercial experience has been reported in hydroforming molybdenum, such an operation would seem practicable provided that certain limitations are observed. Temperature is one limitation which would play a very important part in any hydroforming consideration. Molybdenum must be worked warm and, according to Fig. 1, the temperature will be higher for heavier gauges of material. Since current hydroforming temperature limits are somewhat in the order of 320°C., it would then appear that the limitation for the hydroforming of pure molybdenum would be about 0·09 to 0·1 in. thick. The other limitation which, of course, must be observed, is the deep drawability of molybdenum. Commercial experience indicates that severe deep draws can be accomplished with sheet thickness of the order of 0·01 in. Ratios of 4:1 are regularly reported, and 5:1 has been accomplished in some cases. However, in considering the deep drawability of molybdenum, the required force for deformation is a factor, and thus it would appear that hydroforming would be limited probably to sheets of 0·04 in. thickness, or lighter, at this time. Deep drawing, on the other hand, can be accomplished without regard to the same temperature limitations which would be imposed on hydroforming of molybdenum. Sections as heavy as $\frac{1}{8}$ in. have been deep drawn, and in the reported experience, temperatures required for deep drawing were considerably higher than those indicated in Fig. 1. Experience has shown that with $\frac{1}{8}$ in. thick stock sizes, deep drawing temperatures should be of the order of 600° to 700°C.

Some sources advise that tools used for deep drawing operations should be maintained at the working temperature and in all cases where there is sliding motion between the molybdenum part and the tool, it is indicated that some material of low coefficient of friction be used, such as aluminium-bronze. If steel tools are used they must be fully lubricated with a light oil. It is also indicated that the diameter after the first draw in deep drawing must not be smaller than 60 per cent of the starting diameter, and that forming should be performed in one operation if possible. It is always advantageous to complete the deep drawing operation in a minimum number of draws. One manufacturer uses castor oil as a lubricant on the workpieces in the pressing operations, and uses strip heaters on the drawing dies themselves. The stages in making some deep drawn parts from molybdenum are shown in Figs. 12a and 12b.





Courtesy Climax Molybdenum

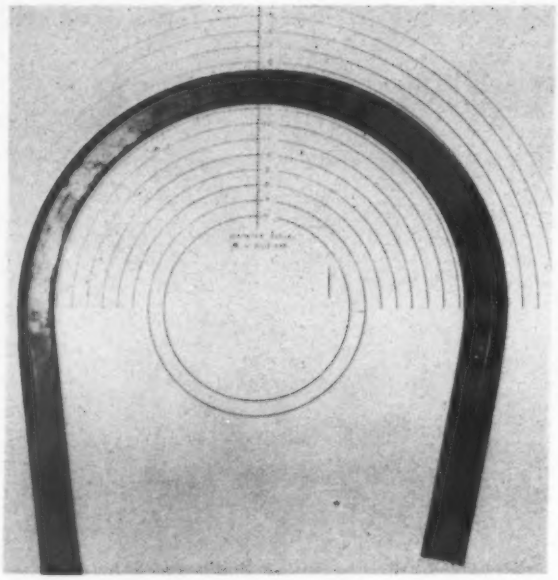
Fig. 12a—Examples of deep drawn molybdenum shapes. Fig. 12b—Final stages

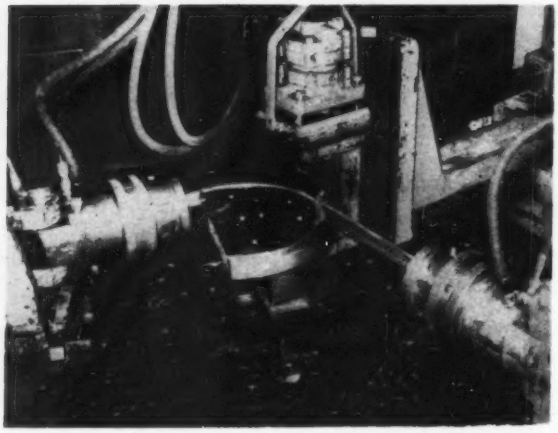
Another forming process somewhat akin to hydroforming, deep drawing, and bending, is the stretch forming process. Some examples of stretch-formed molybdenum are shown in Fig. 13. In this particular case there were about twenty different steps involved in drawing the molybdenum, and the majority of them were conducted at 650°C.

A secondary process to the deep drawing operation is the drawing of molybdenum tubing. An illustration of drawn molybdenum tubing is given in Fig. 14. In most cases, small diameter molybdenum tubing is drawn cold, with stress relief being given between each drawing step. Reductions are of the order of 5 per cent to 10 per cent per draw. The drawing operation parallels that employed for the drawing of solid wire of molybdenum.

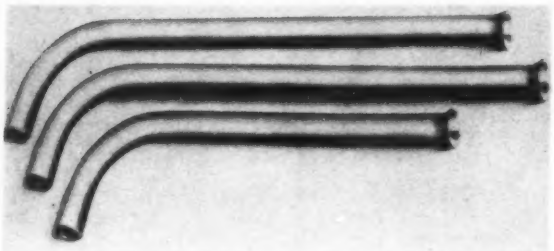
The sawing of molybdenum is readily accomplished on standard commercial equipment. When carried out as a machine sawing operation, no precautions need be taken other than those which are normally considered for the sawing of high-strength, heat-resistant alloys. The cutting rates for molybdenum are about 80 strokes/min. at 0·004 in. feed on power hacksaw equipment, and 100 ft/min. with a six-tooth blade at a pressure setting of $2\frac{1}{2}$ on DoAll band saw equipment. Sawing losses are generally about $\frac{1}{8}$ in. allowance for saw kerf, and about $\frac{1}{16}$ in. for camber which may be developed during the sawing of heavier sections. Abrasive cut-off wheels are also used, and the same consideration would apply to their use as has been described for standard sawing operations. The most suitable cutting speed for rubber-bonded silicon carbide wheels to cut molybdenum is approximately 800 ft/min.

Whenever hand hacksawing is employed, the sawing of light gauges only should be considered. The reason for this may be well illustrated by Figs. 15, 16 and 17. Bearing in mind the weakness shown in Fig. 4, it can readily be seen that any motion which tends to generate tension stresses in the thickness direction can cause cracking or, literally, separation of the grains. Consequently, hand sawing operations must be done very carefully even to the extent of backing up the molybdenum between sheets of some other less critical material, such as copper, brass, aluminium, or carbon steel. The illustration shown in Fig. 17





[Courtesy Marquardt Aircraft Co.



[Courtesy Fansteel Metallurgical Corporation

Above: Fig. 13a and Fig. 13b — Examples of stretch-formed molybdenum

Right: Fig. 14—Drawn molybdenum tubing

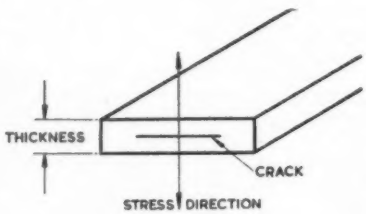
is illustrative of what happens when sawing takes place under improper conditions.

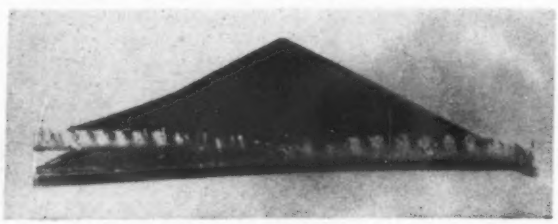
Shearing requires considerably more skill than sawing, and is generally conducted warm. Sizes smaller than 0·025 in. thickness (or diameter) may be sheared cold. Heavier sizes will develop failures such as shown in Fig. 16 if they are not properly heated. It is current practice to shear sheet of any thickness, and to shear plate and bar stock up to a maximum of $\frac{1}{8}$ in. thickness. Fig. 1 may be taken as a guide to the operation, but a less exacting procedure of equal suitability is to heat the work to redness and shear it as quickly thereafter as possible. The sheared edge will possess a considerable amount of drag, which is especially noticeable in the heavier gauges. Some camber will be developed as a result of the "walking" of the metal during the shearing operation in the case of sheet or plate. Shearing camber can be held normally to about $\frac{1}{8}$ in. in 5 ft. (based on $\frac{3}{32}$ in. thick stock). It is important that shearing tools be sharp enough, because dull tools can cause cracking even though proper shearing temperature has been developed.

For the manufacture of ribbon, such as is used in heating elements, or for precise length and width considerations, particularly in the manufacture of welded tubing from sheet or strip, it is necessary that slit edges be produced. Slitting can be accomplished at room temperature on all gauges up through 0·025 in. thick. It is necessary to consider heating gauges heavier than this. Standard performance of slitting machines will produce widths to within 0·001 in. of desired width for strip up to 2 in. wide, and for strip as wide as $17\frac{1}{2}$ in., slitting tolerances of ±0·005 in. can be obtained. The minimum length which can be conveniently slit is 12 in.

Punching and stamping operations are variations of the shearing operation, the only major difference being that cracks or secondary tensile failures are more likely to develop in these than in straight line shearing operations. It is best to consider the necessity for blanking of shapes somewhat oversize so that any tendency for shear cracks or secondary tensile splitting may be machined out or hand filed away as the shape is prepared to final size. In the heavier sections of sheet, which may very well be punched or blanked, it may be necessary to machine to final dimensions, particularly in the case of round pieces. In this case, the same precautions should be adhered to as in hand sawing (e.g. a back-up should be provided of carbon steel or some other material on each side of the molybdenum sheet), and the machining operation should be conducted along the edge, and not at right-angles to it.

[Courtesy Sunstrand



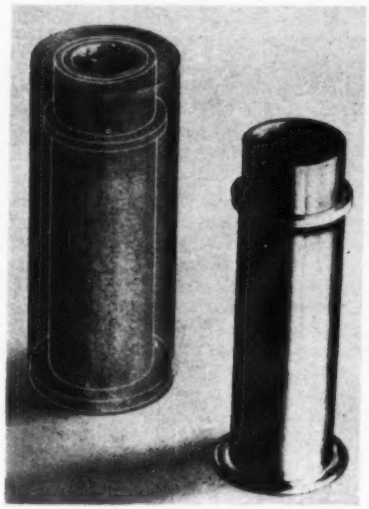


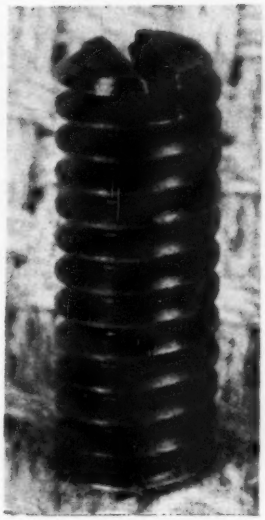
[Courtesy Marquardt Aircraft Co.

Fig. 15, Fig. 16 and Fig. 17—Effects of improperly-sawn molybdenum

Machining

For lathe turning, planing, milling or boring, the universal recommendation is carbide tools. Grades similar to the Kennametal grade K6 or Carboloy grade 883 are suitable, and a standard carbide-tipped tool, such as one





[*Courtesy Fansteel Metallurgical Corporation*

Fig. 18 and Fig. 19—Examples of machined molybdenum

originally designed for machining cast iron and non-ferrous metals, is quite satisfactory for modification to machine molybdenum. Such a style as the industry standard style BL, containing any of the satisfactory carbide tips, will do the job. The alteration recommended by Westinghouse for turning molybdenum is top rake, 6°; clearance angles, 7°; and nose radius, $\frac{1}{64}$ in. for all size tools. It is recommended that the largest shank size that can be adapted to the lathe being used is recommended for tool rigidity (preferably a molybdenum shank should be used, because of its higher stiffness). There seems to be some difference of opinion as to how much back rake should be allowed. One recommendation calls for 0° back rake, and another one calls for between 20° and 25° back rake. An end relief angle of between 6° and 10° is considered satisfactory.

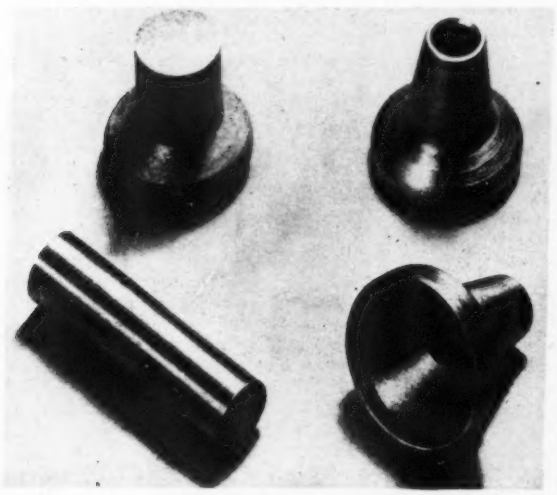
Speeds and feeds are given in Table II for machining, and represent information developed by Westinghouse Electric Company. In all cases a copious supply of coolant must be maintained. It has been found that any chlorinated solvent, such as carbon tetrachloride or trichloroethylene, will do the job quite satisfactorily. For purposes of comparison, it might be said that molybdenum machines in a manner similar to a steel of Rockwell C Hardness 30.

Screw cutting requires extraordinary care compared to lathe turning or standard machining. Cutting speeds are about $\frac{1}{4}$ to $\frac{1}{2}$ of those used in lathe turning (30-40 ft/min.) and feeds are very light, being of the order of 0·003 in. to 0·005 in. Cutting tools must be high speed tools only. It is necessary to use a reasonably high speed stream of emulsified cutting oil or chlorinated hydrocarbons containing whiting. The purpose of this is twofold: (1) to keep the work cool, and (2) to remove chips as rapidly as possible. Coarse threads are to be preferred over fine threads, inasmuch as fine threads tend to break. When coarse threads are developed, the depth of the thread need be only 70 per cent to 80 per cent of that normally cut in steel.

Drilling operations in molybdenum should be conducted with two-lipped carbide drills. The cutting edges are carbide tipped, and it is also desirable to use carbide wear strips at one or more places along the shank if deep drilling is being conducted. Carbide grades similar to those referred to for lathe turning are satisfactory. Drilling speeds should be from 40-45 ft/min., with a feed of about 0·003 in. per revolution. Coolants required are the same as those indicated previously. Examples

TABLE II—MACHINING DATA ON MOLYBDENUM

	Speed, ft/min.	Feed, in.	Depth of Cut, in.
Turning			
Roughing	200	0·015	Up to $\frac{1}{8}$
Finishing	400 to 500	0·008	0·003 to 0·015
Milling			
Roughing	110 to 130	0·005 in. per tooth chip load	Up to 0·050
Finishing	380 to 400	0·005 in. per tooth chip load	0·003 to 0·015
Drilling			
HSS	30 to 35	0·003	
Deep Drilling			
Carbide	40 to 45	0·003	
Shaping	Ram Spd., 26	Hand feed 0·004 to 0·007	$\frac{1}{16}$



[*Courtesy Fansteel Metallurgical Corporation*

Left : Fig 20—Steps involved in producing a machined molybdenum shape

Right: Fig. 21—Piercing point machined from molybdenum

TABLE III—GRINDING DATA ON MOLYBDENUM

Wheel*	Wheel Speed ft/min.	Work Speed ft/min.	Table Travel ft/min.	Depth of Cut in.
Cylindrical Grinding				
Roughing GA-60-L-6-V10 GA-80-L-8-V10	6500	250-300	1·5 to 2	Up to 0·0005
Finishing GA-80-M-8-V10 GA-100-M-6-V10	6500	250-300	1·0 to 1·5	Up to 0·0002
Surface Grinding				
Roughing GA-60-L-6-V10 GA-80-L-8-V10	6500			0·002 to 0·005
Finishing GA-80-M-8-V10 GA-100-M-6-V10	6500			0·0005 to 0·001

**Carborundum Co. identification: any comparable wheel may be used.*

of machined and drilled parts from molybdenum are shown in Figs. 18, 19, 20, and 21.

Molybdenum can be ground to any degree of finish and tolerance that is desired. Centreless grinding is regularly conducted to furnish close tolerance molybdenum bar stock from the mill, and is equal in cost and, therefore, preferable to centreless turning wherever a choice exists. Grinding information is given comprehensively in Table III. In general, grit sizes finer than 80 grit of aluminium-oxide, silica-bonded wheels are to be preferred, even though they become loaded rapidly and require frequent dressing. Grit sizes larger than 80 grit cut more freely, but the surface finish produced is unsatisfactory. As in other machining and metal removing operations connected with molybdenum, a good supply of coolant is necessary.

(To be continued)

Standard Wire Gauge

As the result of extensive publicity given to the subject of basic sizes for sheet, strip and wire, a committee of the British Standards Institution was able recently to reach the conclusions summarized below on the problem presented by the multiplicity of sizes in current use.

They found that the S.W.G. is too well established a standard to supplant, so far as its use in Britain is concerned, but that there was no hope of getting the S.W.G. established as an international series under I.S.O. auspices, largely because the Americans did not use the S.W.G. and would be most unlikely to accept it.

The committee considered whether they could contemplate the adoption in Britain of the range of thicknesses represented by the American preferred number series in inches. For this proposition there was support from the representatives of only one large firm; the rest of the committee felt unanimously that it would confuse matters in this country rather than the reverse. It was felt that there was no adequate reason at present to disturb the current use here of S.W.G. and B.G.

There was, indeed, little hope of securing agreement among the inch-using countries on an inch series of thicknesses for the I.S.O. recommendation. The general feeling was that for international purposes the I.S.O. metric series already agreed upon would be sufficient, and that there would be no advantage in introducing a parallel inch series.

In view of this recommended limitation, it was felt that much of the argument for a system of code designations in addition to the metric thicknesses was removed, particularly as the metric countries in the I.S.O. committee had never shown any enthusiasm for a code or gauge designations. In this respect, the correspondence attracted by the previous publicity showed that British industry largely shared the Continental view on the matter.

It was felt, however, that due importance should be given to a provision in the present draft I.S.O. proposal that the method of designating the thickness of sheet or diameter of wire should be by stating the basic size in millimetres, followed (if desired) by the letter "U" to indicate that this size belongs to the international metric series.

Small Copper Tubes

ISSUED by the Copper Development Association to aid designers and craftsmen in dealing with installations of small bore ½ in. forced circulation heating systems, a booklet entitled "Copper Tubes for Small Bore Heating Installations" has recently been issued. It sets out, in six chapters, the fundamentals of the domestic hot water supply, discusses various aspects of the design of heating systems, pump and control equipment, and describes installation methods. It is available from the Association at 55 South Audley Street, London, W.1.

Men and Metals

Chairman of the Kestner Evaporator and Engineering Company Limited, **Mr. J. Arthur Reavell,** M.I.Mech.E., M.I.Chem.E., F.I.M., is at present on a tour of his company's South Africa offices and associated plants.

Recent appointments to the staff of Landmaster Limited, a member of the Firth Cleveland group, include those of **Mr. J. E. Bryden** as home sales manager, and **Mr. A. P. McNeil-Smith** to the sales staff.

It is announced by Sunvic Controls Limited that **Mr. C. E. Walters** has been appointed general sales manager covering all the company's products.

Two new directors have been appointed by The General Electric Company Limited in the persons of **Mr. S. G. Catto,** a managing director of Morgan Grenfell and Company, and **Mr. R. N. Millar,** general manager of the company's heavy engineering and nuclear establishments at Erith.

In succession to the late Sir Claude Gibb, **Mr. F. W. Gardner,** deputy chairman of C. A. Parsons and Company, has been appointed chairman of the company. **Mr. H. H. Mullens,** chairman and managing director of A. Reyrolle and Company, and a member of the Parsons board, has been appointed deputy chairman, and **Mr. G. M. Baker,** a director and general manager of C. A. Parsons and Company, has been appointed managing director.

It has been announced by Metropolitan-Vickers Electrical Company Ltd. that **Mr. H. West,** M.I.Mech.E., M.I.E.E., has been appointed assistant managing director of the company. He has ceased to act as director of Electrical Engineering. Mr. West is also a director of Metropolitan-Vickers—Beyer, Peacock Limited; Sunvic Controls Limited; and Isotope Developments Limited; and also chairman of Nuclear Graphite Limited.

A director of A. Reyrolle and Company Ltd., **Mr. J. Bennett** has been appointed general manager of the company. **Mr. R. B. Fenwick,** the general works manager, has also been co-opted to the board.

Managing director of Dewrance and Company Limited, **Mr. J. M. Storey** has been appointed vice-chairman of the Council of British Manufacturers of Petroleum Equipment. Mr. Storey was awarded the C.B.E. in the New Year's Honours List.

It is understood that **Sir John Cockcroft** has accepted an invitation to become the first Master of Churchill College of Technology and Science, which is to be built at Cambridge. Sir John, whose name will always be associated with the Atomic Energy Research Station at Harwell, is at present a full-time member of the Atomic Energy Authority in charge of scientific research.

Research Progress

Magnesium Alloy Investigation

BY RECORDER

ALLOY development programmes usually take one of two forms —either a very detailed and systematic investigation of the effects of altering the ratios of major alloying elements present, and of making further minor additions, is carried out on a basic alloy showing interesting properties, or a broad-fronted attack is adopted in which the most obscure elements may be added to a pure metal or simple alloy. The latter approach is normally used only when the basis metal involved has not previously been available for extensive study, or when a physical or mechanical property not usually considered to be of interest is a deciding factor in the choice of material for a new application. There are, of course, practical and economic limitations to the number and amounts of alloying elements that can be used even in a broad-front research on binary systems, and it is often found that the choice of alloying additions is made on the basis of some general hypothesis about the likely effects of certain types of element when used for alloying purposes. For instance, it now seems to be fashionable to concentrate on the addition of high melting point metals to a material if improvement of elevated temperature properties is being sought.

It is relatively uncommon, however, to find that such a research has been planned on a basis that does not seem to be related to the desired object. This seems to be the case though, in an investigation carried out by R. R. Nash *et al* of the Rensselaer Polytechnic Institute, New York State.[1] These workers had as their "ultimate goal the development of new, wrought magnesium-base alloys with improved mechanical and physical properties." The additions used (titanium, hafnium, rhenium, yttrium, nickel, cobalt, tantalum, chromium, vanadium, niobium, boron, tungsten, and molybdenum) were chosen, however, because these elements have relatively high melting points, although the authors at no time suggest that elevated temperature properties were of primary interest.

Alloy Preparation

Most of the alloys were prepared in 15 lb. heats using 99·8 per cent min. magnesium ingots. The additions were made either by the use of the alloying element direct, of hardeners, or of reducible compounds: in several systems a variety of methods was employed, and a comparison of their effectiveness was thus possible. The study was complicated by extensions of the work in which the effects of selected additions on the mechanical and physical properties of certain magnesium alloys (e.g. magnesium-0·5 per cent manganese-3·0 per cent zinc) were investigated. Full details of the melting procedures for all of these materials are given by the authors, who also describe the subsequent fabrication of the cast $8\times3\times\frac{1}{8}$ in. slabs to 0·064 in. sheet. (Where expensive alloying additions were being used, the melt weight was sometimes restricted to 200 gm., and a few alloys containing either chromium or rhenium were extruded from $\frac{1}{4}$ in. diameter billets into 0·175 in. diameter rod.)

The as-cast grain sizes of the alloys were measured, most of the additions being potential grain-refiners. Tensile properties and compression yield strengths were determined on the rolled sheets, and a limited number of tensile tests were carried out at 400° and 500°F. (205° and 260°C.). Corrosion tests at room temperature in which the attack after 24 hr. in *N* sodium chloride solution was compared with that on samples of commercial FS1-O alloy (magnesium-3·0 aluminium-1·0 zinc-0·3 manganese), gave a qualitative assessment of the resistance of the various materials.

Titanium Additions

The effects of titanium additions were among those extensively studied by Nash and his colleagues. Although in the majority of the alloys the nominal titanium content was about 0·01 per cent (titanium being only slightly soluble in magnesium), one or two materials were produced having nominal contents of up to 4·2 per cent titanium. Titanium was introduced into the melts as sponge, titanium dioxide powder, titanium tetrafluoride, tetrabromide or tetrachloride, as potassium fluotitanate, or in the form of a manganese-titanium hardener containing 35 per cent (nominal) titanium. Titanium tetrachloride, when used, was first absorbed in dry, pure barium dichloride except in one instance, where tetrachloride vapour was bubbled directly through the melt.

Examination of the results presented for the series of titanium-bearing materials reveals some discrepancies. For instance, the authors suggest that titanium dioxide additions equivalent to 0·12 wt. per cent titanium give a grain refinement dependent on the mesh size of the added titania. Thus, in a set of results grouped together, the as-cast grain size of the basis magnesium is given as $0{\cdot}30\times0{\cdot}05$ in. (i.e. columnar), of magnesium plus +42 mesh TiO_2 as $0{\cdot}12\times0{\cdot}03$ in., and of magnesium plus −200 mesh TiO_2 as 0·012 in. (i.e. now equiaxial). Unfortunately, a further result given later, which indicates that an apparently comparable addition-free melt of the basis magnesium gave an equiaxial grain size of 0·015 in., is ignored. A further fault, arising possibly in drafting, lies in the authors' statement that certain results for a 3 Zn-Mg alloy "were not available" although, in fact, the properties in question are given in full.

Figures for this alloy also are questionable in other respects, since two sets of properties are given for apparently the same melt. In the first, the elongation is shown as 6 per cent, in the second as 17 per cent: the yield and ultimate values also differ, but not so widely as elongation. It is probable that the second set represents the true properties of this alloy. The titanium additions are then seen to increase ductility slightly, 0·21 per cent titanium (as K_2TiF_6) and 1 per cent titanium (as Mn-Ti hardener) both giving about 20 per cent elongation. This effect is, unfortunately, accompanied by a substantial fall in yield and ultimate strengths.

Most of the other materials investigated were little affected by additions of titanium, although the authors claim improved hot-rolling characteristics were obtained. Since the nature of this improvement is not described specifically, no conclusion can be drawn about the value of this observation.

Other Additions

Hafnium, rhenium, vanadium, cobalt and tantalum additions (up to 1 per cent) also had little effect on the mechanical properties of magnesium and some magnesium alloys, the ductility usually being slightly impaired without compensating increase in strength. Three of the tantalum-bearing materials—one containing 1 per cent tantalum powder, the others 0·1 per cent tantalum as TaK_2F_7—and two magnesium-1 per cent rhenium alloys gave excellent resistance in the 24 hr. brine corrosion test. Other nominally similar melts showed this behaviour to be non-reproducible, and Nash *et al* are unable to offer an explanation for the exceptions. The sensitivity under corrosive conditions of magnesium alloys to the presence of trace impurities would seem to be a likely cause of these anomalies.

Over 20 alloys, containing nickel additions up to 2·2 per cent, were examined, the nickel being introduced as powder, 30 per cent magnesium-70 per cent nickel

(*Continued on page* 92)

Products and Processes

TRENDS IN THE DEVELOPMENT, APPLICATION, PROCESSING, DESIGN AND WORKING OF NON-FERROUS METALS AND THEIR PRODUCTS

Core Pulling

A SERIES of toggle units designed for core pulling on die-casting dies, and for press work applications on sheet metal where considerable power is required, has been introduced by Engineering Tool and Product Design Co. Limited.

The units incorporate hydraulic or pneumatic cylinders which transfer their thrust to a ram through a toggle linkage. Four sizes are manufactured, with ram movements of 1 in., 1½ in., 2 in. and 3 in. respectively.

All these units, because of their toggle action, combine high pulling and thrusting power with a positive mechanical lock when the ram is fully extended. This locking feature makes them particularly suitable for applications where the toggle ram is subjected to a high opposing force in the locked position, as, for example, holding cores in a die-casting die.

Each unit consists of a Meehanite frame with a hydraulic or pneumatic cylinder rigidly attached to it. A ram in the form of a sliding block is held captive in the centre of the frame by means of replaceable phosphor bronze bearings, placed at either side. Linear movement of this ram is obtained from pairs of toggle links, pivoted at one end to the frame and at the other end to the ram.

The ram has a threaded hole or T slots machined in its outer end to allow attachments of any desired shape to be fixed to it.

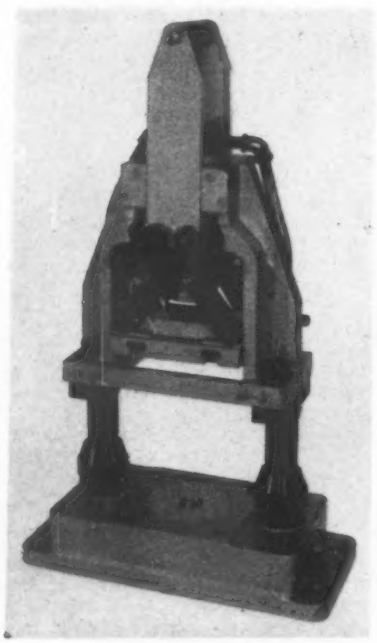
The method of machining and mounting the toggle links allows for shoulders to be incorporated at each pivot point. These shoulders are designed to relieve the pivot pins of any direct shear when the ram is placed under a compressive load—the shoulders formed by the links butting together when the ram is fully extended.

The toggle links are attached to the operating cylinder by means of drag links. These drag links are pivoted on the central bearing pins of the toggle links at one end, and on the yoke attached to the piston rod at the other end.

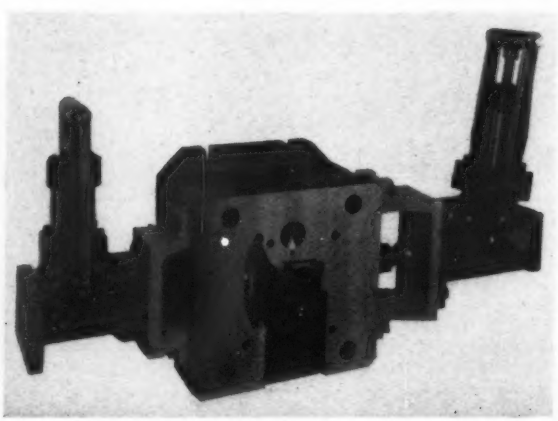
The frames of the units are designed with flanges to enable them to be rigidly bolted to any desired surface or mounting bracket.

The 3 in. stroke unit, shown below, is mounted on two pillars attached to a base frame. This illustrates one method of mounting the toggle unit, and in this instance allows its use as a bench press capable of exerting loads of 10 tons at approximately $\frac{1}{32}$ in. from the bottom of stroke.

A 2 in. stroke unit, also shown, is mounted on the right-hand side of a die-casting die pulling a core 1¼ in. dia. by 1⅞ in. long. A 1 in. stroke unit is mounted on the left-hand side. The use of these toggle units on this die for withdrawing the cores resulted in a simpler and cheaper die, with smaller die blocks than would have been possible with the use of angle pins and core slide blocks.



Left: The 3 in. stroke toggle unit made by Engineering Tool and Product Design Co. Ltd.



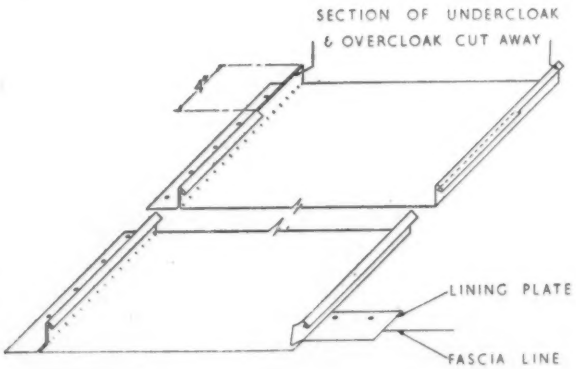
Right: A 2 in. stroke toggle unit mounted on the right hand side of a die, with a 1 in. stroke unit on the left hand side

Preformed Roofing Sheets in Copper

PREFORMED roofing sheets have not been given a great deal of attention by the building industry, and with this in mind The Copper Development Association has devised a form of roofing which is simple to make up and, at the same time, can be used either as a self-supporting roof or applied to an underdecking.

It may be used in 24 or 26 S.W.G., and in sizes varying from 8 ft. long, and in widths from 16 to 24 in. The roofing sheets are joined at the sides by a form of standing seam, so that the completed roof resembles the familiar pattern of a traditionally laid copper roof.

The illustration clearly shows how the sides of the roofing sheet are folded, prior to taking on to the building site. The fixing of the sheets is by means of a web, as shown on the left-hand side of the diagram, which is secured by screws



Right: Arrangement of new-type copper sheets for roofing.

or copper nails to the timber rafter, and the width of sheet is calculated so that the folded edge on the other side of the sheet falls on the centre of the next rafter. This is usually at 16½ in. centres.

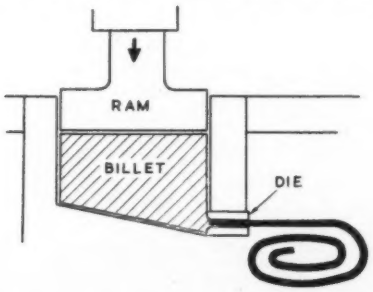
The fixing holes in the web allow for expansion and contraction movement. The endwise joint can be either a plain lap, or a water clip may be fitted in between the two edges, depending entirely upon the pitch of the roof. To facilitate endwise joining together of the sheets, it will be noticed that the flange that is folded over on the left-hand side is cut away so that the lower edge of the top sheet may slide between the two remaining vertical portions. This ensures a watertight joint at this point. At the gutter, the bottom edges of the sheets are fixed by folding over a lining plate, previously secured to the roof timbers. This gives adequate fixing and is proof against wind and rain. At the ridge, capping pieces are fitted to complete the work.

Improvement of Properties in Extrusions

AS a means of producing the maximum internal working on metal being extruded, and to equalize more nearly than is usual the longitudinal and transverse properties, a process is being developed in which the billet is hot extruded through a die set at an angle of 90° to the direction of the applied force (see diagram). The process is still in its early stage of development, but the improvement of properties obtained in initial experiments indicates that there may be a wide field of application for it.

Work has been carried out on stainless steels, high-speed tool steels, copper alloys, aluminium, and titanium. In a Paper given to the American Society of Automotive Engineers, investigations are described in which SAE 6150 steel wire has been produced by this "cross extrusion" method. The wire, 0·410 in. in dia., had a surface finish similar to that required by standards for hot rolled wire; tolerances were ±0·007 in. on dia. and ovality within 0·015 in.

It is thought that the process will be useful where quantities are too small to justify rolling. It can also be used to produce extrusions from a cast billet which have properties equivalent to those obtained from a forged or rolled section.



Control of Heating and Ventilation

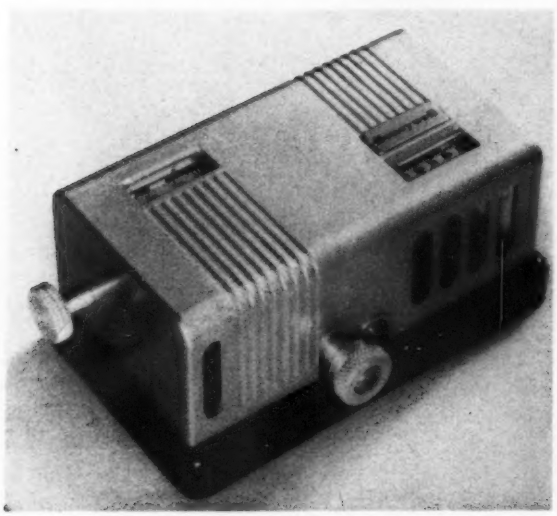
VENTILATING problems in factories and other large areas which use unit heaters and forced air convectors for basic heating may be minimized by a thermostat unit devised by Honeywell Controls Ltd., in which an additional control takes over in hot weather to operate the fans when the heating plant is shut down.

A unit heater installation can be controlled entirely from the thermostat, enabling the operator to run the equipment automatically, as with a conventional thermostat, or continuously regardless of temperature factors. It also allows him to stop the fans completely when the space will be unoccupied for considerable periods.

The thermostat has a three-position manual control with a locking device which prevents it being altered by unauthorized persons. The three positions are: Automatic—which brings the conventional function of the thermostat into operation; On—which allows the fans of unit heaters to turn even when the thermostat is not calling for heat; and the Off position—which shuts down the plant completely. This new thermostat, and a purely automatic thermostat also with a loading of 4 kW, are available with or without a built-in thermometer. Both the thermostats are intended for use with low voltage or line equipment, such as radiators, unit heaters, immersion heaters, cooling equipment, solenoid valves, contactors and starters.

Epoxy Resins Assist Temperature Control

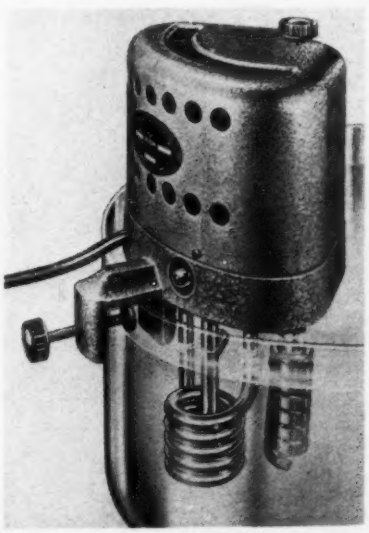
IN operation, a new thermostatically-controlled Techne Tempunit temperature control unit depends upon the efficient functioning of a bi-metal coil which unwinds as the temperature of the bath increases. The coil is protected by an "Araldite" coating—an example of the use of epoxy resin coatings, for in this equipment the resin must be flexible enough to withstand the mechanical stresses applied when the dissimilar metals expand and contract, and must also accommodate movement in the coil unit itself. Equally important, the resin seals the entire coil and so eliminates the risk of corrosion resulting from the creation by the dissimilar metals of an electrical field. Finally, the coating enables the Tempunit to be used for the temperature control of bath media up to a temperature of 95°C. The manufacturers, Techne (Cambridge) Ltd., have found that satisfactory operation of the bi-metal coil is dependent upon the use of "Araldite" epoxy resin coatings.



Above left: In the cross extrusion process, the die and ram are set at 90° to each other

Left: The Honeywell thermostat control for regulating heating and ventilation

Right: The Techne "Tempunit" incorporating a bi-metal coil protected with "Araldite" epoxy resin



Pressure Die-Casting Review

Die-Castings for the Hoover Junior

As an example of what can be achieved when production engineers and product designers achieve close co-operation, the new Hoover Junior Cleaner is outstanding. As with most contemporary cleaners, pressure die-castings form the main components — the housing, the fan chamber and the exhaust duct— and these castings are machined and processed on an entirely new production line.

To produce this cleaner, a complete re-design was needed, and a new conception of production methods had to be put into effect, notably for machining and assembling the main casting and its components.

It is impossible to say whether the major feature is that the line has been engineered to facilitate production, or that the designers set out to plan a product which would lend itself to high productivity by modern techniques. It is, in fact, an amalgam of the two, a case of each department having thought in terms of the other's problems.

The production line itself has a number of remarkable features, and is the most highly mechanized yet laid down at Hoover Limited's Perivale, Middlesex, factory. By ingenious interlinking of special-purpose machines, using belt conveyors and gravity chutes by-passing machines as required, a single line, which has been achieved in a remarkably small space, machines all three components of the body, in spite of the fact that they are all very different. The different components are separated as they go through the line, with each component being directed to its own appropriate machines and then, finally, converging again at the end of the line for final assembly.

To build a line that would deal with the three different components set a problem for the production engineers. The body had to be so planned that it satisfied the advanced design envisaged and, at the same time, provided components which were machinable on such a line—no easy problem either for the engineers or the designers.

Simplified Casting

The body is much lower than on the previous Junior and has a considerably improved streamlined appearance. The previous cleaner comprised a complex pressure die-casting, combined with a plastics motor housing. The new model comprises three much simpler die-castings, which are machined independently and then assembled into one complete unit. The motor is housed in a separate plastics casing, in turn enclosed within the main housing.

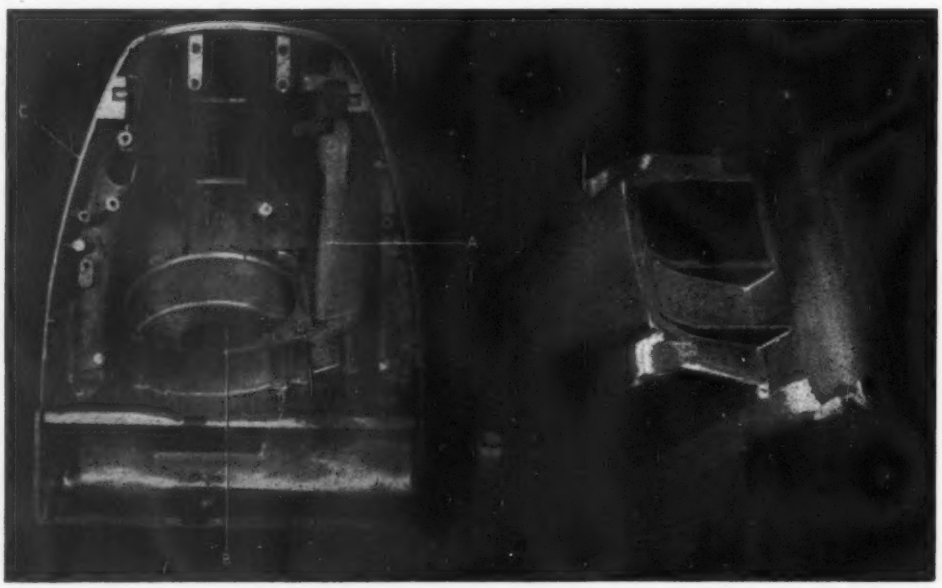
Routing

The fan chamber and the exhaust duct both go through a disc linisher at the beginning of the line, and are then routed to a twin gravity chute, divided down the middle, providing in effect twin chutes for the two components. These lead to a Wadkin milling machine, developed from the Wadkin high-speed router and having a rotary table specially developed to Hoover Limited's requirements. The components are mounted in pairs on this table, which provides positions for four such pairs. The machine is one of the fastest of its type in operation. It carries out the face milling on both components, and uses a 6 in. six-tooth cutter operating at 4,000 r.p.m. This speed is well within the capacity of the machine and, if required, spindle speeds up to 6,000 r.p.m. could be obtained.

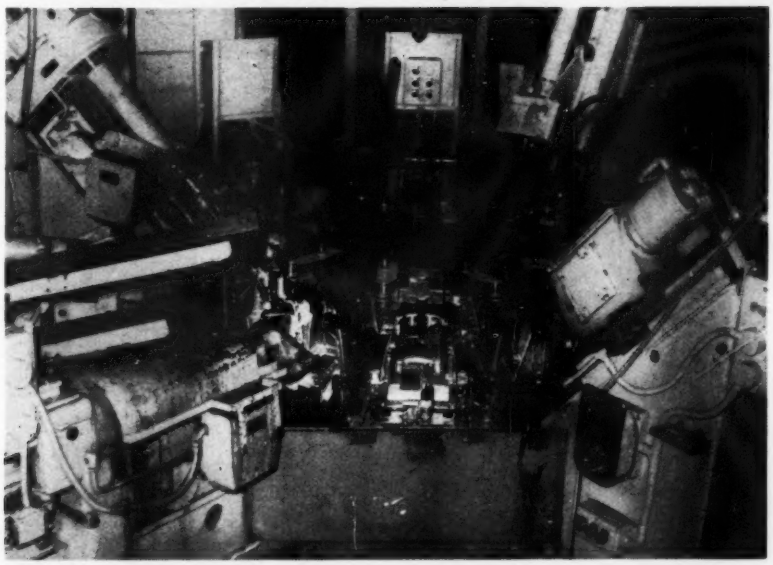
One production difficulty was clamping the components in the table fixtures because of their awkward shape. This is done automatically as part of the machine cycle. The operator places them in their fixtures, but only clamps them with sufficient pressure to maintain them in position. Then, as they pass round towards the milling head, they pass under a roller, which presses them firmly into their seatings, and a pneumatically-operated side cam on the table then lifts the component up against the locating faces just before milling. After passing through the milling operation, a similar cam unclamps them.

The high rate of metal removal is such that special dust extraction arrangements have had to be made. Built by Dustraction Ltd., of Leicester, the extraction unit has a capacity of 10,000 ft^3/min.

After they have been face milled, the components are placed by the operator on two more gravity chutes, one chute for each component—and they part company as they pass down the line. The exhaust duct travels only a short way along the line to a special three-way Adams drilling machine. After



New Hoover Junior casting. (A) is the exhaust duct, an irregularly-shaped die-casting which, after machining, is mounted to the fan housing (B) forming a sub-assembly which is then assembled into the main casting (C)



Above left: Wadkin rotary table milling machine, as specially developed to Hoover Limited's requirements. It is used for milling the fan chamber and exhaust duct of the cleaner. As the components pass round towards the milling head they pass under a roller, seen at the left

Above: Six-station Archdale rotary transfer machine. The end of the chute with components waiting to be machined and the six-station machine itself can be seen

Left: An Archdale rotary transfer machine used for the main housing. It has 10 operating stations and drills a total of 19 holes in the housing of which 13 are tapped. The complete drilling and tapping operations are carried out on this machine

Below left: The Dawson washing machine where the three die-cast components converge for washing. The two smaller components come in from the left, while the housing arrives via the sloping chute

drilling, they are tapped on an adjacent No. 2 Huller tapping machine and then, drilled and tapped, they are placed on a Sovex powered conveyor which runs underneath the gravity chute.

In the meantime, the fan chamber has by-passed this station and arrived at a six-station Archdale rotary transfer machine. Here, all holes are drilled and tapped on the fan chamber. After passing through the machine, they are removed by the operator, and they also go on to the Sovex conveyor.

The largest of the three castings, the main housing, takes a still different route. At the beginning of the line, it passes through a special hydraulic piercing machine, to pierce the flash on the casting and, at the same time, make the six small vent holes at the front of the casting. Then, similarly to the other two components, it passes

The housings travel via the short gravity chute on the extreme right and are then scurfed and polished on the Taylor backstand machine on the left

through a Jackman disc linisher, and bench fettling.

After fettling, the main housing casting is placed on a gravity chute, which takes it half-way down the line, direct to another special Archdale rotary transfer machine. This machine is larger than the Archdale machine used for the fan chamber, having 10 stations. It drills a total of 19 holes in the housing, of which 13 are tapped. The complete drilling and tapping operations are carried out on this machine. Probing stations, between drilling and tapping positions, use standard hypodermic needles, an air jet being passed through the orifice of the needle to clear out swarf while the needle itself acts as a highly sensitive probe.

The drilled and tapped housings are then placed on another short gravity chute. Both this chute and the Sovex conveyor carrying the fan chamber and exhaust duct lead to a Dawson industrial washing machine, where all three components now converge for washing.

After washing, the exhaust duct and fan chamber go via another gravity chute to a sub-assembly bench, where they are assembled together, and a spot-facing operation is carried out. The housings travel via a short gravity chute for scurfing and polishing on Taylor backstand machines. They are then placed on yet another gravity chute between the polishing heads and are carried to the assembly bench, where they meet with the sub-assembly of the fan chamber and exhaust housing. The sub-assembly is mounted into the housing, thus completing the body assembly. The line then doubles back on itself for a short run, the completed assembly returning via a gravity chute, sloping in the opposite direction, to another high-speed Wadkin miller similar to that used at the beginning of the line, and a final face-milling operation is carried out on the complete body. From here, the bodies go to the end of the line again via inspection benches, any rectification is carried out, and the body goes to a degreasing unit. After degreasing, the bodies go to a floor above for painting.

Although the line deals with three separate components, it is extremely compact, and only about 100 ft. long.

Research Progress—*continued from page* 87

hardener, or as anhydrous nickelous chloride. Comparative tests indicated that the best recoveries, particularly at the 1 per cent nickel level, were obtained using nickel powder. Although a few preliminary tests showed that 1 per cent nickel improved both the ultimate strength and elongation values given by as-cast magnesium bars, the wrought magnesium-nickel binary or more complex materials gave rather erratic results of little promise.

Only three materials containing boron, four containing niobium, two with tungsten additions, and one with molybdenum, were prepared. None of these gave significant improvements in either mechanical properties or corrosion resistance. A larger number of yttrium-bearing alloys were produced, however (on a 200 gm. max. scale), but unfortunately most were melted in clay-graphite crucibles, which introduced an interdendritic network of contaminants that may have masked any effects of the addition. Melts prepared in a graphite crucible gave improved yield and ultimate strengths, although a statistical study would be required to confirm the significance of the increases. A similar reservation may be made in respect of the claim that chromium additions of about 0·3-0·5 per cent to the FS1-O alloy substantially improved strength without destroying ductility, particularly as the improvement was confined to extruded rod and could not be obtained in rolled sheet of the same nominal composition.

Reference

1 R. R. Nash *et al;* Wright Air Development Center, Technical Report 55-207, 1957, PB 131198.

Die-Casting Defects

ONE of the most puzzling faults affecting aluminium pressure die-castings is the intermittent incidence of "inclusions"—the presence of hard spots or particles in the casting which become apparent when any machining has to be carried out. The causes put forward for this phenomenon are legion, but none has so far provided a basis for its control.

A positive correlation between holding-furnace location and the appearance of inclusions was cited by H. R. Abram in a Paper to the Slough Section of the Institute of British Foundrymen. With furnaces sited on an ordinary concrete floor, the fault was absent, even with a component susceptible to this particular defect, but when transferred to a machine which had a holding-furnace located on a granolithic floor, inclusions immediately appeared. There is an *a priori* likelihood, therefore, that granite chips were inadvertently introduced to the melt and, being fragmented by the heat, were transferred as minute particles to the shot-sleeve, and so became entrained in the injected metal.

A further operational factor to which adequate attention has not, perhaps, been given is the effect upon the die surface of large, discrete drops or blobs of lubricant. Many dies after a period of operation display surface markings and depressions which are generally attributed to the hammering effect of metal debris left between the die members at closure, and the operator is blamed accordingly. Observation shows, nevertheless, that damage of this sort occurs at locations on the die face where it is highly improbable that it could result from the hammering of flash, whereas all the indications are that it could be caused by hydrostatic deformation of the surface through the trapping of viscous lubricants between the die faces at closure.

Obituary

Mr. E. L. Heathcote

WE regret to record the death of Mr. Eric Lancaster Heathcote, F.C.A., senior partner in the firm of Heathcote and Coleman.

He was secretary of numerous trade associations, including the British Bronze and Brass Ingot Manufacturers' Association and the Association of Bronze and Brass Founders, and many others, mostly connected with the bolt and nut, light alloy and foundry trades.

Mr. H. A. Stevenson

IT is with regret that we record the death of Mr. Horace A. Stevenson, managing director of Alexander Controls Ltd. Since 1920 he had specialized in the manufacture of automatic control instruments, and had held a controlling interest in Ether Limited.

Industrial News *Home and Overseas*

A New Title

Permission has been granted by the Board of Trade for the organization known as Incorporated Plant Engineers to change its name to **The Institution of Plant Engineers,** and this change took effect from January 16 last. The offices of the institution are at 2 Grosvenor Gardens, London, S.W.1.

A Removal

It is to be noted that as from Monday last, January 26, the commercial, export and publicity departments, and London and Home Counties area office, of **Sunvic Controls Limited** are located at Crown House, Aldwych, London, W.C.2.

Apprentice Awards

At a ceremony presided over last week by the chairman of **Birmid Industries Ltd.,** Mr. Edward Player, C.B.E., awards were presented to apprentices of the company by Mr. Stephen Burman. Also in attendance at the ceremony was the Mayor of Smethwick, Coun. W. J. Darby.

For the first time the "Berry" trophy, given in memory of a former director, was presented, and went to Mr. G. B. R. Jones, an electrician, for the best all-round achievement in workshop and technical school studies. Mr. D. J. Kind, a metallurgist, received the "Percy Pritchard" memorial prize for being the apprentice showing the best all-round achievement during his fifth year.

Aluminium Fire Escapes

Another new use for aluminium in constructional work is reported by **Northern Aluminium Company Limited.** Six aluminium fire escapes have recently been installed at the Royal Gwent Hospital, Newport, Mon. These escapes were designed, manufactured and erected by Lyte Ladders, of Rogerstone, and their associate company, Lyte Aluminium Ltd. The installation incorporates the results of several years of development work, and includes certain design features that are covered by British and foreign patents.

The primary requirement for hospital escapes is that the platforms should be long enough to allow for the easy manipulation of stretchers around bends. Each escape unit comprises a number of platforms connected by stairways. The platforms, supports, treads, stringers, stanchions and tubular handrailing were fabricated from Noral B51 SWP (B.S. HE30WP) alloy supplied by Northern Aluminium Company Limited. Joining was carried out by the use of aluminium rivets.

The legs of the platform supports were concreted into the walls to a depth of 6 in. to 8 in. Angled supports running from the outer edge of the platforms were fixed to the wall below by expanding bolts—a technique that avoids the ingress of rainwater into the brickwork. The platforms were so light that no "to ground" or upright supports were required. The stairways were then riveted to the platforms to make a solid construction. It was only where stairways were unusually long that they were fixed to the wall, in which case a support was lugged into the wall about halfway in order to prevent any tendency to side whip. At ground level the stairways were anchored to a concrete slab.

The treads were made from a special extrusion of patented design, having a serrated upper surface to provide a safe non-slip surface in severe weather conditions.

Visiting Head Wrightson

During his recent tour of the industrial areas in the North, the Prime Minister visited the works of **Head Wrightson and Company Limited** at Thornaby. In his brief tour of the works he saw some of the major fabrications for the iron and steel industry, and the giant heat exchangers for the Bradwell Nuclear Power Station in course of construction.

To commemorate his visit, the Prime Minister was presented with a book describing the sea voyage of the heat exchangers from the company's works to the Bradwell site. This novel method of transportation was necessary because of the size of the heat exchangers, which made normal delivery by rail or road impossible.

A Luncheon Meeting

For its February luncheon meeting the **Non-Ferrous Club** is departing, for the first time, from a long-established custom —that of having some well-known man as its guest speaker. The innovation on this occasion is that the guest speaker is to be a lady—Miss Noele Gordon, A.T.V.'s "Lunch Box" hostess.

Because of her television engagement, Miss Gordon will be unable to join the club at its usual luncheon hour, and for that reason the club has postponed its meeting time for half-an-hour. It will meet on this occasion at 12.45 p.m., for 1.15 p.m., at the Queen's Hotel, Birmingham, on Wednesday next, February 4.

German Chemicals

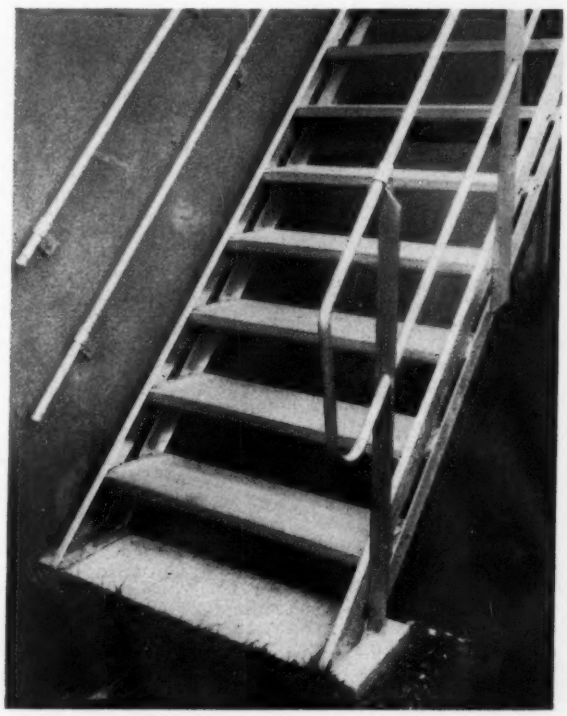
It has been announced by the London firm of **Charles H. Windschuegl** that they have been appointed sole distributors of the wide range of products of Chemische Fabrik Stockhausen and Cie, of Krefeld. The range of chemicals concerned covers a wide industrial field, and among these are the following for the wire drawing industry:—Unopol CB: a drawing oil for all types of wire, but in particular for copper and copper alloy wires; Unopol HMN: a lubricant for wet drawing of fine and very fine wire, particularly for copper wire with starting diameter of less than 0·5 mm.

Radiographic Equipment

We are informed by a new London firm—**R. F. Fraser-Smith**—that they are able to supply radiographic equipment and accessories, and in particular they are manufacturers of Gamma ray equipment of a new design. It is understood that this firm will welcome enquiries on the subject of non-destructive testing.

Thai Tin Barter

It is reported in Bangkok that officials of the Thai Department of Mines are studying the possibility of shipping tin ore, outside the International Tin Council quota, in exchange for United States goods. The report said Dr. Puey Eungpakorn, Thai representative to the last I.T.C. conference in London, had



A section of one of the six aluminium fire escapes recently installed at the Royal Gwent Hospital, Newport, Mon.

reported that I.T.C. had decided to approve barter by Bolivia of non-quota tin for U.S. surplus agricultural products. Thailand was enquiring if America would offer goods other than surplus agricultural products in exchange for tin, and if it was possible to exchange tin for U.S. goods useful to Thailand a request would be made to the I.T.C. for permission similar to that given to Bolivia.

A Welding Pack

For use in shops where a wide range of work is undertaken, the **Suffolk Iron Foundry (1920) Ltd.** are now marketing a two-in-one pack which comprises the Sifbronze general duty blow pipe and a Sifbronze Demon cutting blowpipe.

In addition to the blowpipes themselves, the case contains 10 welding nozzles for use with the general duty model and three cutting nozzles for the cutting blowpipe. Demon cutting nozzles are made in seven sizes, ranging from $\frac{1}{32}$ in. to $\frac{1}{4}$ in., and this new pack contains any three sizes to welders' requirements. The size of the pack, which is a neat metal box, is $22\frac{1}{8}$ in. by $7\frac{1}{8}$ in. by $4\frac{1}{2}$ in. The price is 18 guineas.

Automatic Welding Equipment

It has been announced by **Quasi-Arc Ltd.** that they have now introduced a new scheme for replacing automatic welding machines. Self-propelled Fusarc and Fusarc/CO_2 machines, extensively used in the shipbuilding and engineering industries, can now be returned within nine years of their purchase, and a fully-reconditioned machine will immediately be delivered from stock. The reconditioned machines will all be of the latest Mark III type, and will carry the company's normal 12-month guarantee. The price is fixed regardless of the condition of the returned machine, provided it is complete, but will vary slightly depending on its age and whether it is a Mark I or II model or the later Mark III.

The chief advantages of the scheme from a customer's point of view are the saving of capital expenditure and the fact that no time need be lost in waiting for machines to be reconditioned.

A London Meeting

On Thursday next, February 5, the London Local Section of the **Institute of Metals** will hold a meeting at their headquarters, 17 Belgrave Square, S.W.1, at 6.30 p.m., when Mr. B. Fullman, B.Sc., F.R.I.C., F.I.M., will give an address on "Metallurgical Information."

The "20" Club

At the annual dinner of the Canning "20" Club, held in Birmingham last week, sixteen new members of the club received their rewards. The club includes some 300 employees with 20 years' continuous service with **W. Canning and Company Ltd.** Among those present at this function were Sir Ernest Canning, President of the club, and Mr. F. H. Ewens, a vice-president of the club and chairman of the company.

A Cricketing Personality

Assistant manager of the Birmingham area for **Head Wrightson and Co. Ltd., Mr. R. T. Spooner,** better known to cricketers as "Dick" Spooner, intends to give up regular appearances in cricket, but his services will be available to the Warwickshire County Cricket Club for part of the season.

Before taking up professional cricket, Mr. Spooner served an apprenticeship with Head Wrightson, and after serving in the R.A.F. he rejoined the company as a sales representative in the Midlands.

Contract for G.E.C.

Valued at over £200,000, a contract has been placed with **The General Electric Co. Ltd.** for the supply of two turbo-blowers for the furnaces at the new works of the South Durham Iron and Steel Co. Ltd., West Hartlepool. The blowers are similar in design to those being manufactured by the G.E.C. for the Broken Hill Proprietary Company, Australia, and for the ISCON steelworks at Durgapur, India.

Connected to Telex

It is learned from **Griffin and George (Sales) Ltd.** that their offices and warehouse at Cheetham Hill Road, Manchester, are now connected to the Telex system on Telex 66-450.

Persian Ores

News from Teheran is to the effect that a number of Japanese companies are interested in Persian metal ore deposits. The reports state that, so far, some 10 tons of ore samples, primarily lead, zinc and chrome, have been shipped back to Japan for tests.

Contract from New Zealand

Reports in London state that the **Aluminium Wire and Cable Company Ltd.,** of Swansea, have received a £253,000 order from the New Zealand State Hydro-Electric Department for steel-cored aluminium conductors for a 220 kW transmission line in the South Island.

Nuclear Congress

Details of the 1959 Nuclear Congress have been announced. Forty sessions are to be held during the five-day congress, which begins on April 5 next at the Public Auditorium in Cleveland, U.S.A. Features of the meeting will be engineering Papers dealing with advances in reactor technology, talks devoted to problems of industrial management in the nuclear field, and Papers devoted to laboratory problems in radioactive materials.

Full particulars of the programme for this event may be obtained from the Engineers Joint Council, 29 West 39th Street, New York 18, N.Y.

Tin Statistics

Advance figures issued in London last week by the International Tin Council say that November 1958 figures for mine production of tin-in-concentrates show a fall in output in the Belgian Congo (728 tons), Bolivia (1,458 tons) and Nigeria (413 tons). In December, Nigerian production was only 213 tons.

Exports of tin-in-concentrates from Bolivia and Thailand in November, 1958, fell to 1,310 tons and 548 tons respectively. Only 377 tons of tin-in-concentrates were exported from Indonesia in October.

Imports of tin-in-concentrates into the Federation of Malaya and Singapore (627 tons) and the Netherlands (862 tons) were both lower in November. There were no imports of tin-in-concentrates into the U.S. during August and September.

Exports of tin metal from the Federation of Malaya and Singapore fell to 1,782 tons in December. Exports from the Netherlands and the United Kingdom were both lower in November (2,274 tons and 584 tons respectively).

Imports of tin metal into the U.S. during September, at 3,655 tons, showed little change from the previous month. During November, imports into France and the Netherlands were both lower, but imports into the United Kingdom rose to 850 tons. Imports into Federal Germany in October were at the high figure of 1,274 tons.

Polish Copper Find

Preparatory work for the exploitation of the copper ore deposit found two years ago in the Glogow area of Polish Silesia has now been completed. Although no figures are available, the deposit is understood to be one of the richest in the world. Exploitation will require a large amount of capital, and it is reported that the U.S.S.R. will provide both technical and financial help, according to the P.A.P. news agency.

Russian Tin

A communique was issued by the Chairman of the International Tin Council on Monday relating to the negotiations on tin carried on with the Soviet Union. The communique is as follows:—

"An understanding has been reached between the Head of the Trade Delegation of the U.S.S.R. in the United Kingdom and the Chairman of the International Tin Council regarding exports of tin from the U.S.S.R. during 1959.

"The U.S.S.R. is not a member of the International Tin Agreement and, accordingly, is not obliged to make any commitments in respect of trade in tin.

"Nevertheless, the U.S.S.R. has moved towards the desires of the exporting and importing countries members of the Council, and has confirmed her intention to reduce her tin exports *outside* the Socialist countries in 1959 as compared with the exports in 1958. The answer given to the Council is that it is the intention of the Soviet Foreign Trade Organizations to consider the figure of 13,500 tons the limit for such exports.

"The Head of the Trade Delegation of the U.S.S.R. in the United Kingdom and the Chairman of the International Tin Council, with a view to co-operation between the U.S.S.R. and the Council, will maintain close contact to resolve questions which might arise in connection with this understanding."

Board of Trade Statement

In view of the above statement by the International Tin Council about Soviet exports of tin, the Board of Trade has announced that the restrictions imposed on August 30 last on imports of tin from the Sino-Soviet bloc have been withdrawn, as from Monday last, by an amendment No. 12 to Open General Import Licence (No. 1).

Australian Aluminium

According to reports from Melbourne, Aluminium Foils Australia Proprietary is to construct a factory on a ten-acre site near Sydney, and completion of the scheme is expected by October next. Some £A1m. is to be spent on this project, and we believe that this will be the first

time that aluminium foil will have been produced in Australia.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange warehouses fell by 50 tons, and were distributed as follows at the end of last week:—London, 5,910; Liverpool, 7,735; and Hull, 1,430.

Stocks of refined copper fell by 289 tons and were distributed as follows:—London, 2,200; Liverpool, 1,786; Birmingham, 225; and Manchester, 150.

New Copper Mine

Recent news from Santiago states that the El Salvador copper mine, near Copiapo, in which the Anaconda Company has invested 103 million dollars, goes into production in April. An official of the Andes Copper Mining Company has told Comtelburo that the mine will take the place of Potrerillos, which is to be closed because of the low grade of its ore. The El Salvador plant will produce between 80,000 and 100,000 tons of blister copper a year, the official added.

Potrerillos last year produced 32,935 tons of blister copper, which was well over 6,000 tons less than the previous year. On the other hand, Chuquicamata produced 129,165 tons of electrolytic and 84,403 tons of blister copper in 1958, while El Teniente's output was 58,986 tons of fire-refined and 113,442 tons of blister.

Wet Sanding

A new lightweight angle sander, the CP 3017 AWS, on which Flexback pads can be fitted for wet sanding of irregularly shaped surfaces, has been introduced by the **Consolidated Pneumatic Tool Company Ltd.** This new sander is available in three versions, with spindle speeds of 4,500, 2,700, and 1,500 r.p.m. respectively. The motor in each case consists of a high power "unit type" vane motor, which incorporates a floating rotor. Thus, while 50 per cent more power is obtainable than with other types of motor, end plate wear is eliminated. Ball or needle bearings are used for all revolving parts, and lubrication of the motor is by a built-in oil reservoir, the gearing being lubricated through a convenient filler plug without disassembly of the gearing.

Water feed to the sanding pad is by a water connection feeding through the spindle shaft, and the tool is supplied for operation from a ¼ in. dia. air hose, a ¼ in. female thread inlet being fitted. A lever type throttle is standard, and this is used in conjunction with a dead handle. The sanders are designed for operation with either 5 in. or 7 in. rubber pads or 7 in. Flexback pads.

Copper Tubes and Cylinders

Last year the **Copper Development Association** issued a publication entitled "The Strength of Copper Tubes and Cylinders," to meet the demand for information by users of copper tubes and cylinders, and for guidance concerning the effects of operating conditions on design principles. In the introduction to this booklet there appears the following statement:—"The thickness of copper tubes and cylinders have been and still are sometimes chosen in a rather haphazard manner depending mainly on usage and ready obtainability."

In a recent booklet issued by the Associated Builders Merchants Ltd., entitled "Hot—Cold," this statement has been misquoted on page 14 as follows:—"The above would seem to justify the recent comments by the Copper Development Association wherein they refer to the Standards for copper tubes and cylinders as being haphazard and wasteful."

The Copper Development Association wishes to dissociate itself emphatically from the statement made in this pamphlet of the Associated Builders Merchants Ltd., since no reference was made to British Standards in the introduction from which the passage was misquoted, nor does the statement in any way represent the views of the Association.

Technical Brochures

We learn from **Beryllium Smelting Co. Ltd.** that they can now supply illustrated technical brochures dealing with beryllium master alloys (ingots); casting alloys (ingots); beryllium copper wrought alloys; beryllium metal (beads, billets, powder, rods, tubes, and shapes); beryllium oxide (powder, crucibles, rods, cubes, tubes and shapes); also beryllium nitrate, sulphate, hydroxide, chloride, and sodium beryllium fluoride.

Parliamentary News

By Our Lobby Correspondent

British Aluminium Company. — The Financial Secretary to the Treasury, Mr. J. E. S. Simon, announced in the Commons that the Treasury had given the necessary consents in connection with the acquisition of a majority holding in the British Aluminium Company Limited, by Reynolds-T.I. Aluminium Company Limited, a United Kingdom company.

Consent to an application arising out of a conditional agreement made between British Aluminium Company Limited and the Aluminum Company of America had, in the circumstances, been withheld.

The arrangements made between Tube Investments Limited and Reynolds Metals Company ensured that the control of the British Aluminium Company remained in United Kingdom hands. The arrangements would not be modified without the consent of the Treasury.

Mr. Harold Wilson (Lab., Huyton) asked for an assurance that the new company owning British Aluminium would ensure to the employees of that company the same status, facilities and rights that were granted to them under the previous management.

Mr. Simon replied that the companies that had acquired the control of the British Aluminium Company were very well known for their excellent employment policies. He did not think that there was any reason to doubt that the employees of British Aluminium would continue to receive the same fair treatment that they had had in the past. He added that when communicating the consent they would communicate the desire of the House of Commons that the employees should be treated in every way in a fair manner.

Mr. F. J. Bellenger (Lab., Bassetlaw) asked Mr. Simon on what he based his assurance that control would remain in this country. Was it due to the fact that there were to be only three American directors on the board, or that the majority holding was actually an American one?

Replying in the negative, Mr. Simon said that the majority holding would not be an American one. The essence of the arrangement was that actual control of the company would be by the British company, the Reynolds-T.I. Aluminium Company, in which Tube Investments had a majority holding.

Non-Ferrous Scrap. — Mr. Gresham Cooke (Con., Twickenham) asked the President of the Board of Trade if, with a view to assisting international trade and in the light of the foreign currency that could be earned, he would now remove all the continuing restrictions on the export of non-ferrous metal scrap.

The President of the Board of Trade, Sir David Eccles, replied that he understood that representations on the matter were likely to be made by both scrap merchants and users, and he would consider their views as soon as he received them.

Mr. Gresham Cooke: "As the export of non-ferrous scrap is practically the only thing which is still controlled, and as I understand merchants are in favour of exporting this scrap and think that they can earn foreign currency thereby, does not the President of the Board of Trade agree that the time has arrived to get rid of this rather out-of-date regulation?"

Sir David: "We must await the representations which I understand are coming."

Forthcoming Meetings

February 2—Institute of British Foundrymen. Sheffield Branch. College of Commerce and Technology, Pond Street, Sheffield. "Metal Receivers, Tapping Systems and Slag Disposal." J. W. Grant. 7 p.m.

February 3—Institute of Metals. Oxford Local Section. Cadena Café, Cornmarket Street, Oxford. "New Metals: The Rare Earths." A. D. McQuillan. 7 p.m.

February 3—Institute of Metals. South Wales Local Section. Department of Metallurgy, University College, Singleton Park, Swansea. "Progress in Metallurgy of Deep Drawing and Pressing." D. V. Wilson. 6.30 p.m.

February 3—East Midlands Metallurgical Society. Electricity Demonstration Theatre, Carrington Street, Nottingham. Members' Night—Short Papers presented by Members. 7.30 p.m.

February 4 — Manchester Metallurgical Society. Manchester Room, The Central Library, Manchester. "Micro-Mechanism of Fracture." W. S. Owen. 6.30 p.m.

February 5—Institute of British Foundrymen. Stoke-on-Trent Section. Stipendiary Court Room, Town Hall, Hanley. "Production of Machine-Tool Castings." G. W. Nicholls. 7.30 p.m.

February 5—Institute of Metals. London Local Section. 17 Belgrave Square, London, S.W.1. "Metallurgical Information." B. Fullman. 6.30 p.m.

February 5—Institute of Metals. Birmingham Local Section. College of Technology, Gosta Green, Birmingham, 4. Students' Evening. 6.30 p.m.

February 6—Institute of British Foundrymen. Tees-Side Branch. Teesdale Hall, Head, Wrightson and Co. Ltd., Thornaby-on-Tees. "Moulding Sand —From Mixer to Shake-out." W. B. Parkes. 7.30 p.m.

Metal Market News

INTEREST centred last week mainly on zinc and lead, the former being decidedly weak, especially on Friday when the turnover was unusually heavy for this metal. The cut in the American lead price from 13 to 12 cents was an unsettling factor, but, in fact, our market did not react to anything like the equivalent of this reduction. Publication by the British Bureau of Non-Ferrous Metal Statistics of the November figures in the U.K. showed that usage of refined copper was down by 6,000 tons on October, but the industry absorbed about 1,000 tons more of secondary material. Stocks dropped by about 5,600 tons. In lead, stocks were 5,000 tons down and consumption 2,600 tons lower. The usage of zinc dropped from 29,838 tons in October to 26,432 tons in November, while stocks were 4,000 tons lower at 35,400 tons. A good deal of interest was aroused in trade circles by the report that a question relating to the export of non-ferrous scrap had been asked in the House on January 22. The President of the Board of Trade was reported to have replied to the effect that he understood representations on this matter were likely to be made by both scrap merchants and users, and that he would consider the views put forward as soon as he received them. This battle between the merchant interests and the users has been going on for a long time, virtually since the Government withdrew from its position as supplier of wartime surplus. Since, at the present time, many users of old metal are apparently unable to secure all the secondary metal they require, it would hardly be right in the circumstances to raise the embargo. However, it looks as though the authorities will decide the matter after the parties concerned have made submission of their views of the situation. It is probable that some time will elapse before this matter is finally settled.

Business in standard copper was lower than usual, at 7,000 tons for the week, but on balance not much change took place. On balance, cash lost 30s. and three months £1, the close being £230 10s. 0d. for prompt and £227 forward. At £3 10s. 0d. the backwardation was 10s. less than a week earlier, but on Friday business was done in the ring below £227. In the States, Wall Street was hesitant and rather lower, while values on the Commodity Exchange sagged to some extent, probably in sympathy with the Stock Market. The Stock Exchange here registered a certain amount of nervousness, and this did not help the values in Whittington Avenue. However, in view of quiet consumer demand the Copper Market did not make a bad showing. The recent Government tender was settled last week, and it is believed that all the copper offered was allocated. It will be remembered that delivery of this metal is spread from February to June, but it will be strange if some, at any rate, of this copper does not find its way overseas. What proportion of the Government metal was purchased by consumers and what by merchants is not known. L.M.E. stocks fell by 46 tons to 4,650 tons.

There was a turnover of 570 tons in tin, and on some days trading was very quiet, with virtually nothing doing in the ring. Values kept up very well to close at £763 10s. 0d. for cash and £762 10s. 0d. for three months. On balance, cash gained £3 10s. 0d. and three months £2 10s. 0d., the backwardation being now a feature of the market. Stocks in L.M.E. warehouses fell by 326 tons to 15,125 tons. Lead was weak on the American cut to 12 cents, and after a turnover of 8,025 tons, January dropped by £2 to £70 and April by £1 12s. 6d. to £70 12s. 6d. Zinc was very active, with a turnover of 10,225 tons and a sharp fall in the price, for January closed at £71 15s. 0d., a drop of £4 5s. 0d., while April lost £3 5s. 0d. to £70 15s. 0d. This collapse seems to have been due to fears that there might be a cut in the American price. The backwardation narrowed to £1.

Birmingham

Quiet conditions continue in the Midland metal-using trades. At the recent monthly meeting of the Regional Board of Industry, Major C. R. Dibben, chairman, commented that the machine tool and cycle industries continued to be depressed, the rolling stock makers had insufficient orders, and the heavier section of industry showed no appreciable improvement. It is expected that unemployment figures for the month will show another rise, part of the reason being the severe weather, which threw building and other outdoor workers out of employment. The rolling stock firms, however, will benefit later by orders just given out by the British Transport Commission as part of the railway modernization plan. All the 124 main-line passenger coaches and 59 of the 69 diesel locomotives will be built in the Midlands.

Consumers are aware that most products of iron and steel can be obtained fairly easily from stock, and there is, therefore, no eagerness to place forward contracts. In any case, their needs do not justify it. The market for sheets for the motor trade remains steady, though the flow of material has been dislocated again recently by a labour dispute amongst fabricators. There is no indication of any improvement in the demand for structural steel. Re-rolling mills are working short time, and there is a good deal of unemployment in the foundries. Such raw material as is required can be obtained promptly from the iron furnaces.

New York

Market reports show that over the week-end copper futures were steady in fair volume. Custom smelter copper continued quiet, while producers noted good sales for February. Latest fabricator statistics showed that copper consumption fell in December, but this was expected because of holiday considerations. Traders said statistics were considered generally favourable. Lead was quiet to-day, but in zinc, Prime Western was fairly active, with steel mills active buyers. Tin was quiet and barely steady.

Paris

The French economic situation remains uncertain despite greater confidence in the French franc. The severe austerity Budget is expected to lead to social problems which will not be easy to solve, and may lead to widespread strikes. The recession in France is expected to continue for some time because of the Government's deflationary policy. Prices are already rising steeply. The Government's decision to combat what it calls "price speculation" is not really expected to be any more successful than those of previous governments.

Copper prices, after following the world upward trend, fell again, but demand is down owing to the recession. The devaluation of the franc, coupled to the start of the Common Market, is causing some speculation in metal circles. French industry is considered at a disadvantage, and it is not unlikely that demand may fall. It is not yet certain, however, whether imports from the Common Market countries will, in fact, hit the transformers seriously or not.

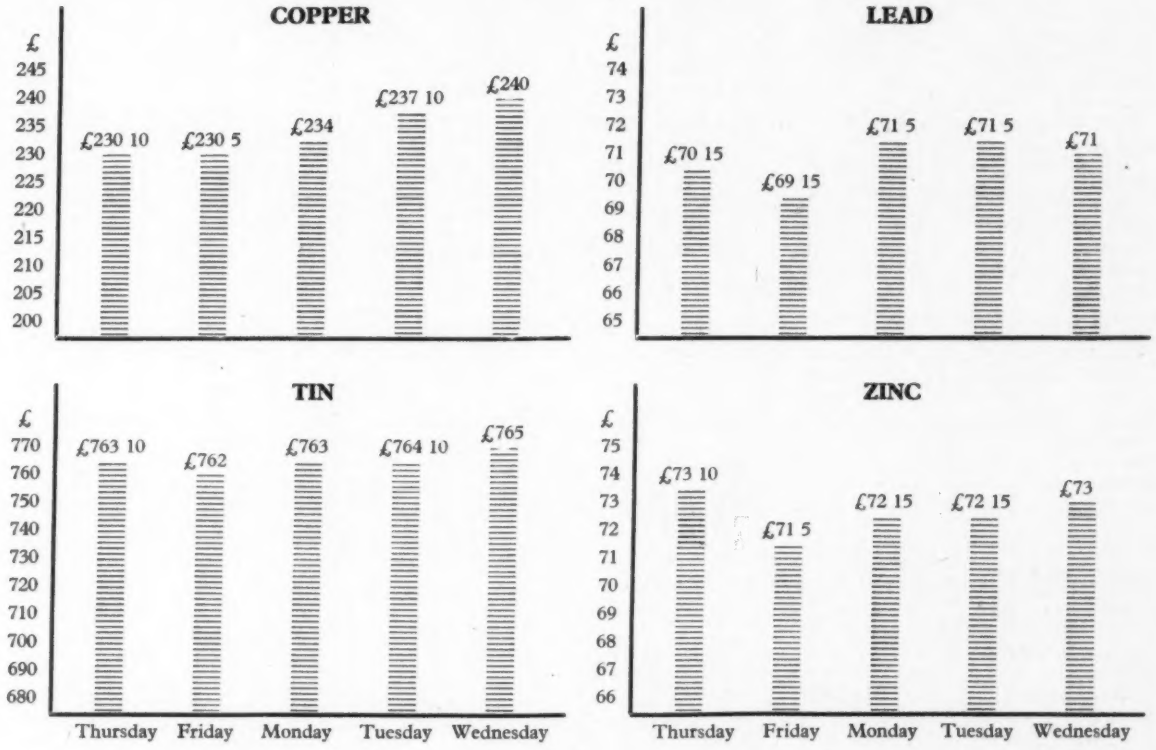
All this has led to a fluid situation in which the industry as a whole is undecided and slightly nervous. It is hoped that by the middle of February the position will have been clarified.

Zurich

Since the turn of the year, business on the Swiss non-ferrous metal market has been on the quiet side. Trade circles say that the decline in purchasing over the past three weeks can be attributed to seasonal considerations. Furthermore, manufacturers are now drawing from stocks they built up during the second half of December. It is anticipated that in February interest will revive, especially on the part of the building industry and of manufacturers of special machines and apparatus.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 22 January to Wednesday 28 January 1959



OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏£/ton		Canada c/lb ≏£/ton		France fr/kg ≏£/ton		Italy lire/kg ≏£/ton		Switzerland fr/kg ≏£/ton		United States c/lb ≏£/ton	
Aluminium			22.50	185 17 6	210	157 10	375	221 5	2.50	212 10	26.80	214 10
Antimony 99.0					220	165 0	445	262 10			29.00	232 0
Cadmium					1,350	1,012 10					145.00	1,160 0
Copper												
Crude												
Wire bars 99.9							440	259 12 6				
Electrolytic	32.00	235 10	28.00	231 5	324	243 0			2.85	242 5	29.00	232 0
Lead			11.50	95 0	104	78 0	171	100 17 6	.90	76 10	12.00	96 0
Magnesium												
Nickel			70.00	578 5	900	675 0	1,300	767 0	7.50	637 10	74.00	592 0
Tin	108.00	795 0			1,093	819 15	1,450	855 10	9.15	777 15	99.75	798 0
Zinc												
Prime western			11.75	97 0 0							11.50	92 0
High grade 99.95			12.35	102 0 0								
High grade 99.99			12.75	105 7 6								
Thermic					109.00	81 15						
Electrolytic					120.00	90 0	173	102 0	.94	80 0	12.75	102 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 2 p.m. 28/1/59)

PRIMARY METALS

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	6
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		16	0
Columbite per unit			—	
Copper H.C. Electro	ton	240	0	0
Fire Refined 99·70%	„	239	0	0
Fire Refined 99·50%	„	238	0	0
Copper Sulphate	„	74	0	0
Germanium	grm.		—	
Gold	oz.	12	10	3¾
Indium	„		10	0
Iridium	„	20	0	0
Lanthanum	grm.		15	0
Lead English	ton	71	0	0
Magnesium Ingots	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	3
Alloy Ingot, A8 or AZ91	„		2	8
Manganese Metal	ton	290	0	0
Mercury	flask	74	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	
Palladium	„	5	15	0
Platinum	„	19	10	0
Rhodium	„	40	0	0
Ruthenium	„	14	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	4⅛
Tellurium	lb.		15	0
Tin	ton	765	0	0
*Zinc				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	72	17	6
Dust 95/97%	„	109	0	0
Dust 98/99%	„	115	0	0
Granulated 99+%	„	97	17	6
Granulated 99·99+%	„	111	12	6

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	„	202	0	0
B.S. 1490 L.M.7	„	216	0	0
B.S. 1490 L.M.8	„	203	0	0
B.S. 1490 L.M.9	„	203	0	0
B.S. 1490 L.M.10	„	221	0	0
B.S. 1490 L.M.11	„	215	0	0
B.S. 1490 L.M.12	„	223	0	0
B.S. 1490 L.M.13	„	216	0	0
B.S. 1490 L.M.14	„	224	0	0
B.S. 1490 L.M.15	„	210	0	0
B.S. 1490 L.M.16	„	206	0	0
B.S. 1490 L.M.18	„	203	0	0
B.S. 1490 L.M.22	„	210	0	0

		£	s.	d.
†**Aluminium Alloys (Secondary)**				
B.S. 1490 L.M.1	ton	142	10	0
B.S. 1490 L.M.2	„	152	0	0
B.S. 1490 L.M.4	„	169	0	0
B.S. 1490 L.M.6	„	186	0	0

†Average selling prices for mid October

***Aluminium Bronze**				
BSS 1400 AB.1	ton	226	0	0
BSS 1400 AB.2	„	241	0	0
***Brass**				
BSS 1400-B3 65/35	„	149	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„	205	0	0
***Gunmetal**				
R.C.H. 3/4%	ton		—	
(85/5/5/5)	„	184	0	0
(86/7/5/2)	„	195	0	0
(88/10/2/1)	„	248	0	0
(88/10/2/½)	„	259	0	0
Manganese Bronze				
BSS 1400 HTB1	„	192	0	0
BSS 1400 HTB2	„	177	0	0
BSS 1400 HTB3	„		—	
Nickel Silver				
Casting Quality 12%	„		nom.	
„ „ 16%	„		nom.	
„ „ 18%	„		nom.	
***Phosphor Bronze**				
B.S.1400 P.B.1.(A.I.D. released)	„	276	0	0
B.S. 1400 L.P.B.1	„	207	0	0
Phosphor Copper				
10%	„	242	0	0
15%	„	245	10	0

**Average prices for the last week-end.*

Phosphor Tin				
5%	ton		—	
Silicon Bronze				
BSS 1400-SB1	„		—	
Solder, soft, BSS 219				
Grade C Tinmans	„	357	3	0
Grade D Plumbers	„	288	3	0
Grade M	„	392	0	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9 „	„		—	
Zinc Alloys				
Mazak III	ton	104	17	6
Mazak V	„	108	17	6
Kayem	„	114	17	6
Kayem II	„	120	17	6
Sodium-Zinc	lb.		2	6

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			£	s.	d.
Sheet 10	S.W.G.	lb.		2	8½
Sheet 18	S.W.G.	„		2	10½
Sheet 24	S.W.G.	„		3	1½
Strip 10	S.W.G.	„		2	8½
Strip 18	S.W.G.	„		2	9½
Strip 24	S.W.G.	„		2	11
Circles 22	S.W.G.	„		3	2½
Circles 18	S.W.G.	„		3	1½
Circles 12	S.W.G.	„		3	0½
Plate as rolled		„		2	8
Sections		„		3	2
Wire 10 S.W.G.		„		2	11½
Tubes 1 in. o.d. 16 S.W.G.		„		4	1

		£	s.	d.
Aluminium Alloys				
BS1470. HS10W.	lb.			
Sheet 10 S.W.G.	„		3	1
Sheet 18 S.W.G.	„		3	3½
Sheet 24 S.W.G.	„		3	11
Strip 10 S.W.G.	„		3	1
Strip 18 S.W.G.	„		3	2½
Strip 24 S.W.G.	„		3	10½
BS1477. HP30M. Plate as rolled	„		2	11
BS1470. HC15WP.				
Sheet 10 S.W.G.	lb.		3	9½
Sheet 18 S.W.G.	„		4	2
Sheet 24 S.W.G.	„		5	0½
Strip 10 S.W.G.	„		3	10½
Strip 18 S.W.G.	„		4	2
Strip 24 S.W.G.	„		4	9½
BS1477. HPC15WP. Plate heat treated	„		3	6½
BS1475. HG10W. Wire 10 S.W.G.	„		3	10½
BS1471. HT10WP. Tubes 1 in. o.d. 16 S.W.G.	„		5	0½
BS1476. HE10WP. Sections	„		3	1½
Beryllium Copper				
Strip	„	1	4	11
Rod	„	1	1	6
Wire	„	1	4	9
Brass Tubes	„		1	10½
Brazed Tubes	„		—	
Drawn Strip Sections	„		—	
Sheet	ton		—	
Strip	„	249	5	0
Extruded Bar	lb.		2	0½
Extruded Bar (Pure Metal Basis)	„		—	
Condenser Plate (Yellow Metal)	ton	186	0	0
Condenser Plate (Naval Brass)	„	197	0	0
Wire	lb.		2	8
Copper Tubes	lb.		2	3½
Sheet	ton	268	10	0
Strip	„	268	10	0
Plain Plates	„		—	
Locomotive Rods	„		—	
H.C. Wire	„	281	15	0
Cupro Nickel				
Tubes 70/30	lb.		3	6½
Lead Pipes (London)	ton	112	5	0
Sheets (London)	„	110	0	0
Tellurium Lead	„	£6 extra		
Nickel Silver				
Sheet and Strip 7%	lb.		3	7½
Wire 10%	„		4	2½
Phosphor Bronze				
Wire	„		4	1½
Titanium (1,000 lb. lots)				
Billet over 4″ dia.-18″ dia.	lb.	63/-		64/-
Rod 4″ dia.-·250″ dia.	„	75/-		112/-
Wire under ·250″ dia.-·036″ dia.	„	146/-		222/-
Sheet 8′ × 2′ × ·250″-·010″ thick	„	88/-		157/-
Strip ·048″-·003″ thick	„	100/-		350/-
Tube (representative gauge)	„			300/-
Extrusions	„			120/-
Zinc Sheets, English destinations	ton	108	5	0
Strip	„		nom.	

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 27/1/59.

	£
Aluminium	
New Cuttings	144
Old Rolled	124
Segregated Turnings	93
Brass	
Cuttings	154
Rod Ends	144
Heavy Yellow	118
Light	113
Rolled	144
Collected Scrap	116
Turnings	137
Copper	
Wire	210
Firebox, cut up	202
Heavy	198
Light	193
Cuttings	210
Turnings	189
Braziery	161
Gunmetal	
Gear Wheels	184
Admiralty	184
Commercial	161
Turnings	156
Lead	
Scrap	62
Nickel	
Cuttings	—
Anodes	530
Phosphor Bronze	
Scrap	161
Turnings	156
Zinc	
Remelted	54
Cuttings	45
Old Zinc	34

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£192.15.0)	220
Heavy copper	(£188.7.6)	215
Light copper	(£162.0.0)	185
Heavy brass	(£109.10.0)	125
Light brass	(£87.12.6)	100
Soft lead scrap	(£57.0.0)	65
Zinc scrap	(£38.10.0)	44
Used aluminium unsorted	(£78.16.0)	90
France (francs per kilo):		
Copper	(£195.0.0)	260
Heavy copper	(£195.0.0)	260
Light brass	(£116.5.0)	155
Zinc castings	(£47.5.0)	63
Lead	(£67.10.0)	90
Tin	—	
Aluminium	(£101.5.0)	135
Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£197.12.6)	335
Aluminium copper alloy	(£126.17.6)	215
Lead, soft, first quality	(£82.12.6)	140
Lead, battery plates	(£47.5.0)	80
Copper, first grade	(£203.10.0)	345
Copper, second grade	(£191.15.0)	325
Bronze, first quality machinery	(£203.10.0)	345
Bronze, commercial gunmetal	(£174.0.0)	295
Brass, heavy	(£138.12.6)	235
Brass, light	(£126.17.6)	215
Brass, bar turnings	(£129.17.6)	220
New zinc sheet clippings	(£59.0.0)	100
Old zinc	(£44.5.0)	75

Financial News

French Capital Increase

Pechiney, France's leading aluminium and chemicals company, has called an extraordinary shareholder meeting for next month in Lyons to secure approval of a capital increase up to the double of the company's present 25,987,500,000 francs. The operation is to be handled either in a single or in several operations, either by cash subscription or incorporating of reserves (or both).

The company also announced that in 1958 the share of export business in its overall turnover represented 27 per cent. In 1957, exports accounted only for 20 per cent of overall business. The results were obtained thanks to the company's competitive prices, the announcement said. The 17·55 per cent devaluation of the franc was expected to promote the export drive. Expansion of exports was expected by the company, particularly in the field of aluminium, for which foreign requirements remained important, the company said. The rise in exports of chemicals and plastics last year was, however, larger than for aluminium.

British Aluminium Co. Ltd.

Tube Investments announces that although their offer has now been declared unconditional they are prepared to continue to receive acceptances at the office of the Registrar, National Provincial Bank Ltd., P.O. Box No. 34, 15 Bishopsgate, London, E.C.2, up to 3 p.m. on Monday, February 9, 1959.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Servis Heat Treatment Co. Limited (616179), 36 Mackenzie Street, Slough, Bucks. Registered December 5, 1958. To take over business of metallurgists and heat-treatment specialists carried on as "Servis Heat Treatment Co.," etc. Nominal capital, £100 in £1 shares. Permanent directors: Albert S. Bolton, Alfred E. Newman and Henry G. Watson.

Tufchrome Limited (616411), Lenco Works, Old Walsall Road, Handsworth Wood, Birmingham, 22a. Registered December 9, 1958. To carry on the business of chromium platers, etc. Nominal capital, £5,000 in £1 shares. Directors: Wm. J. Clements and Maisie F. Clements.

Marine Anti-Corrosion Ltd. (616672), 120 Bishopsgate, E.C.2. Registered December 12, 1958. Nominal capital, £1,000 in £1 shares. Directors: Capt. Sidney R. Bew, Walter W. Brown, and Sydney Hutton.

Wm. Westley and Sons Limited (616826), Vicar Street, Dudley, Worcs. Registered December 15, 1958. To take over business of brassfounders carried on at Vicar Street, Dudley, by Wm. Westley and Wm. Westley, Jnr. Nominal capital, £10,000 in £1 shares. Directors: Wm. Westley, and Wm. Westley, Jnr.

Harefield Metal Limited (616866), Beckleys Yard, 14 High Street, Harefield, Middx. Registered December 16, 1958. Nominal capital, £100 in £1 shares. Directors: Chas. E. Currivan and Thomas B. Simm.

Abbey Metal Finishing Company Ltd. (617406), Weddington Road, Nuneaton. Registered December 23, 1958. Nominal capital, £6,000 in £1 shares. Directors: Jack Cope and Arthur S. Toone.

Bells and Baskerville Brass Foundry Limited (617408), 541 Grand Buildings, Trafalgar Square, W.C.2. Registered December 23, 1958. Nominal capital, £1,000 in £1 shares. Directors: Joseph Jarvis and Matthew W. Keefe.

Westbury Scrap Metal Company Ltd. (617637), 56 Chock Lane, Westbury on Trym, Bristol. Registered December 29, 1958. Nominal capital, £1,000 in £1 shares. Directors: Ernest E. Thatcher and Mrs. Evee N. Thatcher.

Trade Publications

Crane Weighers.—Geo. Salter and Co. Ltd., West Bromwich.

A new brochure has just been issued covering this company's new crane weigher. With the number 99 crane weigher attached to the crane hook, weighing can be carried out as goods are lifted. The brochure illustrates just a few of the many applications for this time- and labour-saving weighing machine.

Dust Control Units.—Dallow Lambert and Co. Ltd., Thurmaston, Leicester.

A coloured leaflet describes in pictures various examples of this company's dust control units in operation.

Grinding Machines.—A. A. Jones and Shipman Ltd., Narborough Road South, Leicester.

Two booklets, recently distributed, give details and illustrations of production grinding machines with specifications, etc., and of a wide range of precision machine tools.

Scientific Instruments — Mervyn Instruments, St. John's, Woking, Surrey.

Particulars are given in two brochures of this company's automatic sulphur dioxide recorder, and polarographic electrode. Both are accompanied by photographs, diagrams and specifications.

Welding Machines. — Sciaky Electric Welding Machines Ltd., Falmouth Road, Slough, Bucks.

Three-phase welding is the subject of a leaflet which gives illustrated details of welding machines produced by this company.

THE STOCK EXCHANGE

Thoughts On A General Election Exercised A Restraining Effect on Markets

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 27 JANUARY	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH	1958 LOW	1957 HIGH	1957 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	23/6		9	10	7 13 3	24/9	17/6	28/3	18/-
400,000	2/-	Anti-Attrition Metal	1/6		4	8½	5 6 9	1/9	1/3	2/6	1/6
38,305,038	Stk. (£1)	Associated Electrical Industries ...	55/-	—2/9	15	15	5 9 0	58/9	46/6	72/3	47/9
1,609,032	1	Birfield	58/-	—3d.	15	15	5 3 6	62/4½	46/3	70/-	48/9
3,196,667	1	Birmid Industries	75/3	—1/3	17½	17½	4 13 0	77/6	55/3	80/6	55/9
5,630,344	Stk. (£1)	Birmingham Small Arms	38/4½	—1/1½	11	10	5 14 6	39/-	23/9	33/-	21/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/-		5	5	6 13 3	16/1½	14/7½	16/-	15/-
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/9		6	6	6 15 3	17/4½	16/6	19/-	16/6
500,000	1	Bolton (Thos.) & Sons	27/6		10	12½	7 5 6	28/9	24/-	30/3	28/9
300,000	1	Ditto Pref. 5%	15/-		5	5	6 13 3	16/-	15/-	16/9	14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6		7	7	6 16 6	20/4½	19/-	22/3	18/9
9,000,000	Stk. (£1)	British Aluminium Co.			12	12		84/-	36/6	72/-	38/3
1,500,000	Stk. (£1)	Ditto Pref. 6%	19/6		6	6	6 3 0	20/-	18/4½	21/6	18/-
15,000,000	Stk. (£1)	British Insulated Callender's Cables	46/9	—1/9	12½	12½	5 7 0	52/6	38/9	55/-	40/-
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	50/6	—2/9	10	10	3 19 3	52/-	28/3	39/-	29/6
600,000	Stk. (5/-)	Canning (W.) & Co.	25/-		25+ *2½C	25	5 0 0	25/3	19/3	24/6	19/3
60,484	1/-	Carr (Chas.)	1/6	+1½d.	12½	25	8 6 9	2/3	1/4½	3/6	2/1½
150,000	2/-	Case (Alfred) & Co. Ltd.	4/10½	—1½d.	25	25	10 5 3	5/3	4/-	4/6	4/-
555,000	1	Clifford (Chas.) Ltd.	22/6		10	10	8 17 9	22/-	16/-	20/6	15/9
45,000	1	Ditto Cum. Pref. 6%	15/3		6	6	7 17 6	16/-	15/-	17/6	16/-
250,000	2/-	Coley Metals	3/-		20	25	3 6 9	4/6	2/6	5/7½	3/9
8,730,596	1	Cons. Zinc Corp.†	59/6	—4/9	18¾	22½	6 6 0	65/3	41/-	92/6	49/-
1,136,233	1	Davy & United	88/-		20	15	4 11 0	87/-	45/9	60/6	42/6
2,915,000	5/-	Delta Metal	24/-	—6d.	30	*17½	6 5 0	25/-	17/7½	28/6	19/-
4,160,000	Stk. (£1)	Enfield Rolling Mills Ltd.	43/-	+1/6	12½	15B	5 16 3	38/-	22/9	38/6	25/-
750,000	1	Evered & Co.	30/-		15Z	15	6 13 3	30/-	26/-	52/9	42/-
18,000,000	Stk. (£1)	General Electric Co.	34/3	—5/9	10P	12½		40/6	29/6	59/-	38/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	37/9		20	17½	5 6 0	39/3	27/3	37/-	26/9
401,240	1	Gibbons (Dudley) Ltd.	66/6		15	15	4 10 3	67/6	61/-	71/-	53/-
750,000	5/-	Glacier Metal Co. Ltd.	7/-		11½	11½	8 4 3	8/3	5/-	8/1½	5/10½
1,750,000	5/-	Glynwed Tubes	18/4½	—4½d.	20	20	5 8 9	18/1½	12/10½	18/-	12/6
5,421,049	10/-	Goodlass Wall & Lead Industries ...	29/3	—1/6	13‖	18Z	4 9 0	30/9	17/3	37/3	28/9
342,195	1	Greenwood & Batley	80/6	—2/-	20	17½	4 19 3	57/9	45/-	50/-	46/-
396,000	5/-	Harrison (B'ham) Ord.	15/-		*15	*15	5 0 0	15/9	11/6	16/9	12/4½
150,000	1	Ditto Cum. Pref. 7%	19/6		7	7	7 3 6	19/9	18/4½	22/3	18/7½
1,075,167	5/-	Heenan Group	8/-	+7½d.	10	10‡	6 5 0	9/7½	6/9	10/4½	6/9
236,958,260	Stk. (£1)	Imperial Chemical Industries ...	34/6	—7½d.	12Z	10	4 12 9	38/-	24/3	46/6	36/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	16/6		5	5	6 1 3	17/1½	16/-	18/6	15/6
14,584 025	**	International Nickel	156	—3‡	$2.60	$3.75	2 19 6	169	132‡	222	130
860,000	5/-	Jenks (E. P.), Ltd.	9/-	—6d.	14	27½φ	7 15 6	10/-	6/7½	18/10½	15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/-		5	5	6 5 0	16/9	15/-	17/-	14/6
3,987,435	1	Ditto Ord.	45/6	+6d.	10	10	4 8 0	47/-	36/6	58/9	40/-
600,000	10/-	Keith, Blackman	25/-		17½E	15	7 0 0	28/9	15/-	21/9	15/-
160,000	4/-	London Aluminium	5/9		10	10	6 19 3	6/-	3/-	6/9	3/6
2,400,000	1	London Elec. Wire & Smith's Ord. ...	70/6	—3/6	15	12½	4 5 0	74/-	39/9	54/6	41/-
400,000	1	Ditto Pref.	24/9		7½	7½	6 1 3	24/3	22/-	25/3	21/9
765,012	1	McKechnie Brothers Ord.	45/-		15	15	6 13 3	45/-	32/-	48/9	37/6
1,530,024	1	Ditto A Ord.	42/6		15	15	7 1 3	45/-	30/-	47/6	36/-
1,108,268	5/-	Manganese Bronze & Brass	14/-		20	27½‡	7 2 9	14/1½	8/9	21/10½	7/6
50,628	6/-	Ditto (7½% N.C. Pref.)	6/-		7½	7½	7 10 0	6/3	5/6	6/6	5/-
13,098,855	Stk. (£1)	Metal Box	67/3	—2/-	11	11	3 5 6	73/3	40/6	59/-	40/3
415,760	Stk. (2/-)	Metal Traders	8/6	—3d.	50	50	11 15 3	9/-	6/3	8/-	6/3
160,000	1	Mint (The) Birmingham	22/-		10	10	9 1 9	22/9	19/-	25/-	21/6
80,000	5	Ditto Pref. 6%	70/6		6	6	8 10 3	83/6	69/-	90/6	83/6
3,705,670	Stk. (£1)	Morgan Crucible A	44/-	—6d.	10	10	4 11 0	45/-	34/-	54/-	35/-
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	18/-		5½	5½	6 2 3	18/-	17/-	19/3	16/-
2,200,000	Stk. (£1)	Murex	47/-	—6d.	17½	20	7 9 0	58/9	46/-	79/9	57/-
468,000	5/-	Ratcliffs (Great Bridge)	11/-	—3d.	10	10	4 11 0	11/1½	6/10½	8/-	6/10½
234,960	10/-	Sanderson Bros. & Newbould ...	27/9	+6d.	20	27½D	7 4 3	27/3	24/6	41/-	24/9
1,365,000	Stk. (5/-)	Serck	18/3		15	17½	4 2 3	18/7½	11/-	18/10½	11/6
6,698,586	Stk. (£1)	Stone-Platt Industries	45/3	—6d.	15	12½	6 12 6	45/6	22/6	33/4½	22/7½
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	16/1½		5½	5½	6 16 6	16/3	12/7½	14/-	12/9
14,494,862	Stk. (£1)	Tube Investments Ord.	73/9	—3d.	17½	15	4 14 9	86/-	48/4½	70/9	50/6
41,000,000	Stk. (£1)	Vickers	34/6	—2/-	10	10	5 16 0	36/3	28/9	46/-	29/-
750,000	Stk. (£1)	Ditto Pref. 5%	15/-		5	5	6 13 3	15/9	14/3	18/-	14/-
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	22/3		*5	*5	6 18 9A	23/-	21/3	24/9	20/7½
2,200,000	1	Ward (Thos. W.), Ord.	84/9	—1/3	20	15	4 14 3	87/3	70/9	83/-	64/-
2,666,034	Stk. (£1)	Westinghouse Brake	41/-	—1/9	10	10	4 17 6	46/6	32/6	85/-	29/1½
225,000	2/-	Wolverhampton Die-Casting ...	8/10½		30	25	6 15 3	10/1½	7/-	10/1½	7/-
591,000	5/-	Wolverhampton Metal	21/9	—3d.	27½	27½	6 6 3	22/9	14/9	22/3	14/9
78,465	2/6	Wright, Bindley & Gell	5/-		20	20	10 0 0	5/4½	2/9	3/9	2/7½
124,140	1	Ditto Cum. Pref. 6%	13/-		6	6	9 4 6	13/-	11/3	12/6	11/3
150,000	1/-	Zinc Alloy Rust Proof	2/10½	—1½d.	27	40D	9 8 0	3/1½	2/7½	5/-	2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting **Shares of no Par Value. ‡ and 100% Capitalized Issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. φ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits. E and 50% Capitalized issue in 7% 2nd Pref. Shares. P Interim dividend since reduced.

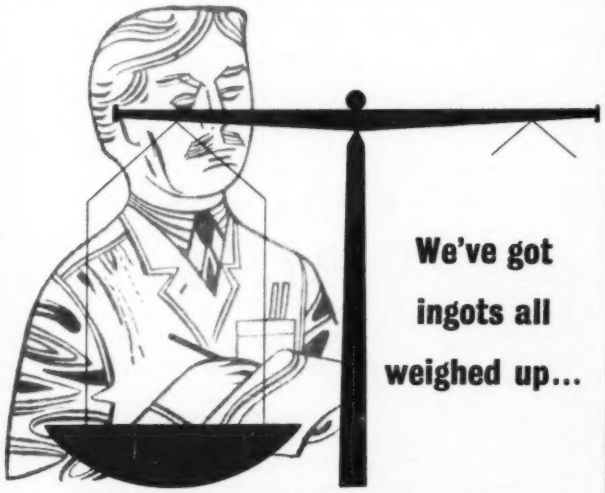
Copper, Brass and Aluminium in Sheets, Tubes, Rods and Wire

DELIVERIES FROM STOCK

T. W. YOUNG LTD.

105 GOSWELL ROAD, E.C.1

Phone: Clerkenwell 2241/2 Grams: Wuzog, Barb.



We've got ingots all weighed up...

....and have had for some time judging by the number of repeat orders simply asking for "same as before." We've long recognised the importance of consistency and—by taking great pains in every stage of production, make up, and analysis of each order—we believe we've ensured standards of the highest uniformity

It is all part of the policy which keeps us in the forefront of ingot metal manufacturers.

Chalmers *make sound* ingots

E. CHALMERS & COMPANY LIMITED
Newhaven Rd., Leith, Edinburgh, Scotland

Telegrams & Cables: "GILES" Edinburgh Telex
Telex 72-232
Telephones: 36611 (5 lines)

Most unusual... ha, ha, ha!

Frankly, the purpose of this advertisement is to bring to your notice that our prices for non-ferrous ingots of the highest quality may well be a good deal cheaper than those you are already paying—and our deliveries are exceptionally good, too. Then why the chap with the camouflaged neck? Well, we rather thought that at first sight you might be more interested in him than in us. But now we have come this far together, may we send you particulars of our production facilities and details of our very keen prices?

Gold Medal Brussels World Exhibition 1958 The Engineering Centre Collective Exhibit

Platt METALS LTD

PLATT METALS LIMITED • ENFIELD • MIDDLESEX • HOWARD 3351

..six of the best!

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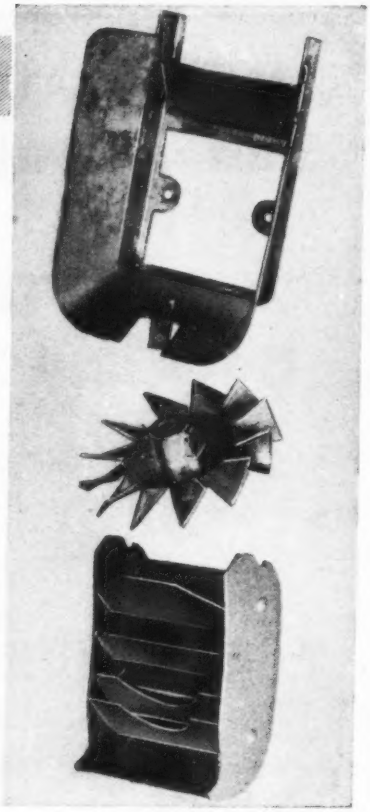

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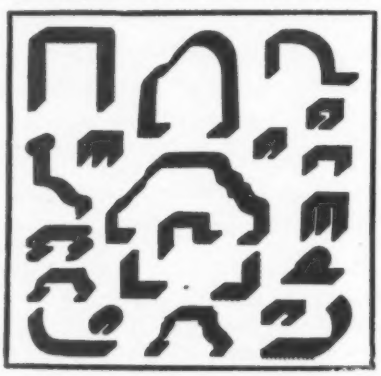

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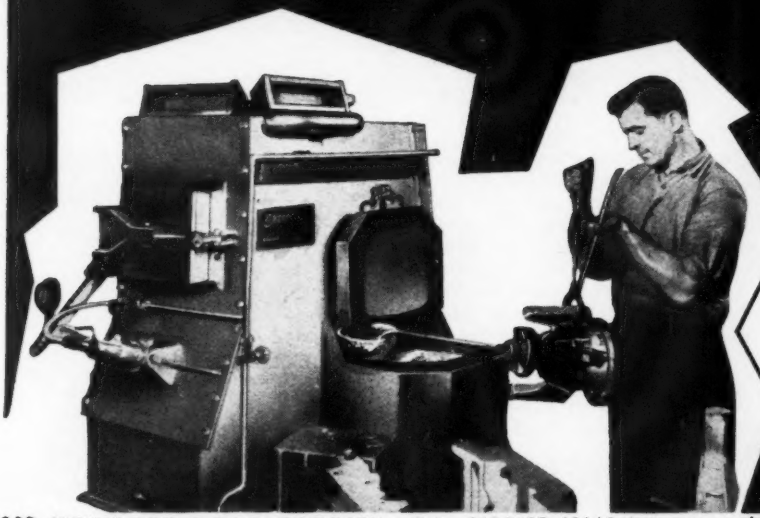

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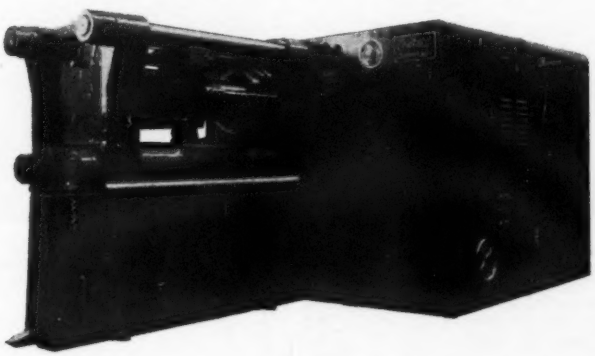

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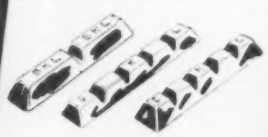

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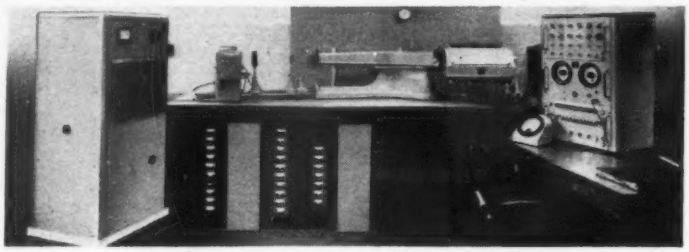

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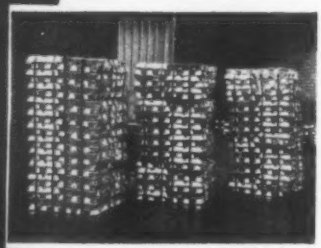

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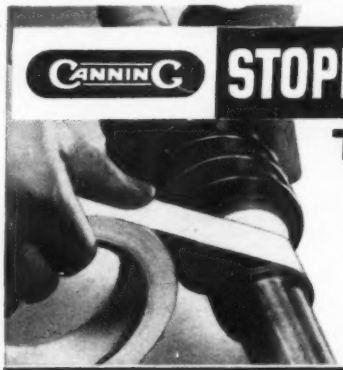

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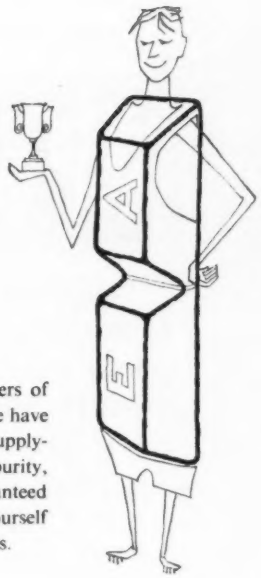

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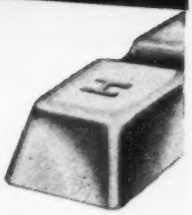

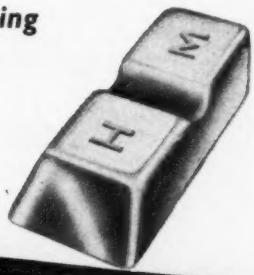

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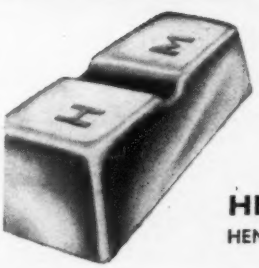

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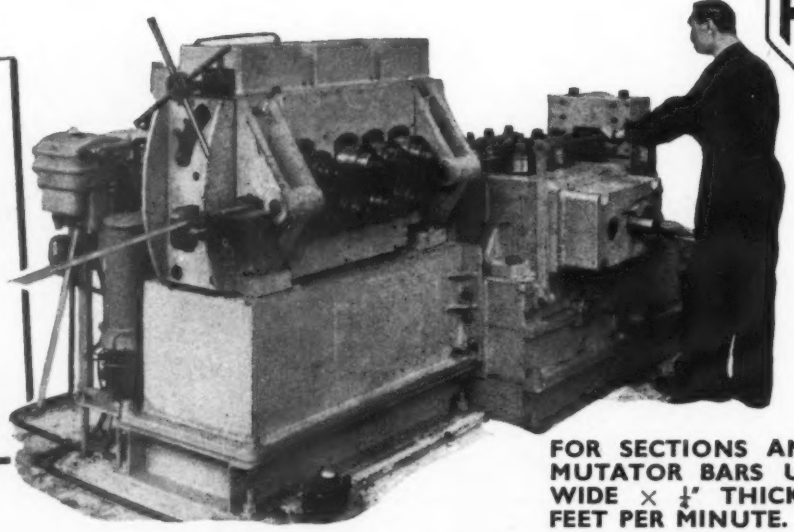

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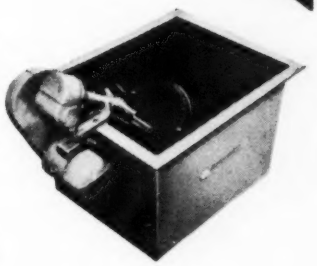

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